

FERNANDO J. MUZZIO

Department of Chemical and Biochemical Engineering
Rutgers University, The State University of New Jersey, Piscataway, NJ 08855-0909

Education

Ph.D., Univ. of Mass. at Amherst, Chemical Engineering, 1991. Thesis: "Non-Linearity, Chaos, and Self-Similarity: Effects of Mixing, Aggregation, Reaction, and Breakup on Structure Formation." (Advisor: Prof. Julio M. Ottino)
B.S., University of Mar del Plata, Argentina, Chemical Engineering, 1985.

Professional Career

Distinguished Professor, Rutgers University, 2013-present
Professor II, Rutgers University, 2007-2013
Director, NSF Engineering Research Center on Structured Organic Particulate Systems, 2006-present.
Director, NSF-NIH Nanopharmaceutical Engineering IGERT training program, 2005-2011
President, Integra Continuous Manufacturing Systems
President and Owner, Mixing Consultants Inc, 1996-2016
Chief Scientific Officer, Acumen Biopharma LLC, 2012-2014
Co-Chair, Technology subcommittee, National Institute for Pharmaceutical Technology and Education, 2005-2007
Chair, Education Subcommittee, National Institute for Pharmaceutical Technology and Education, 2005-2007
Visiting Professor, Department of Chemical Engineering, University of Puerto Rico, 2004-2005.
Professor, Rutgers University, 2000-2007.
Associate Professor, Rutgers University, 1996-2000.
Director, Pharmaceutical Engineering Program, Rutgers University, 1995-2006
Director, Rutgers/NJIT Particle Processing Research Center, 1996-2002
Assistant Professor, Rutgers University, 1991-1996.

Professional Activities

Member, "Promoting Adoption of Continuous Manufacturing", an FDA workshop organized by the Brookings Institution, Washington, DC, October 2015.
Member, Scientific Advisory Board on API/Formulation interfaces, Astra Zeneca, UK, July 2015
Member, NSF Review panel on Foresights, August 2015.
Member, NSF ERC Blue Ribbon Award Recommendation panel, 1/26-1/29, 2015
Consulting Member, Committee on Pharmaceutical Sciences and Clinical Pharmacology, U.S. FDA. July 2014-present
Voting Member, Committee on Pharmaceutical Sciences and Clinical Pharmacology, U.S. FDA. 2010 – 2014
Member, Scientific Advisory Board, Pharmaceutical Engineering Research Center, Graz University, Austria, 2008-present
Member, Scientific Advisory Board, Rutgers Energy Institute, July 2008 – present

Member, Scientific Advisory Board, Rutgers Institute for Advanced Materials, Devices, and Nanotechnology, January 2008-2017.

Member, Board of Directors, Rutgers Center for Innovative Ventures and Technology, January 2008-2014

International Editorial Board member, Chemical Engineering Science, 2014-2018

Editorial Board member, Integrated Pharmacy Research and Practice, 2011-present

Editorial Board member, Journal for Pharmaceutical Innovation, 2007-present

Editorial Board member, Pharmaceutical Technology, 2004-present

Committee of Visitors, NSF Program on Nanoscale Science and Technology, June 2004

Member, PQRI working Group on Blend Homogeneity, 2000-2003

Reviewer; NSF; AIChE J.; Physics of Fluids A; Advances in Polym. Tech.; Ind. and Eng. Chem. Res; J. Am. Ceramic Soc., Chem. Eng. Sci., J. Fluid Mech., Int. J. Pharmaceutics, Pharm Research, Drug Dev. & Ind. Pharmacy, J. Chem. Eng., etc.

Member, College Appointments and Promotions Committee, 2001-2003

Awards

R&D Council of New Jersey Chairman's Award, 2018

Elected member, USP expert panel on Quality Standards for Pharmaceutical Continuous Manufacturing, Nov. 2016-present

Inventor of the Year Award 2016, NJ Inventors Hall of Fame

Professor of the year Award, Rutgers School of Engineering, 2015

Rutgers University Teacher Scholar Award, 2015

University of Alberta Distinguished Speaker Award 2015

PSE Model-Based Innovation Prize 2013

American Institute of Chemical Engineers, North American Mixing Forum 2008 Award for Excellence and Sustained Contributions to Mixing Research and Practice

American Institute of Physics Prize (Gallery of Fluid Motion by Physics of Fluids) "Three-Dimensional Chaotic Mixing", Physics of Fluids, Volume 16(9), S8, P.E. Arratia, MM. Alvarez, T. Shinbrot and F.M. Muzzio

Rutgers Board of Trustees Research Fellow (Gold Star) Award

Dupont Young Professor Award 1995-1997.

Dupont Education Award 1998-2001.

Hoechst-Celanese Young Professor Award, 1995.

Merck Fellowship for Young Faculty Development, 1993-1997.

3M Foundation Untenured Faculty Award, 1993, 1994, 1995.

Exxon Education Foundation Award, 1992, 1993.

Gold Medal for Academic Achievement (1985 highest GPA, University-wide), University of Mar del Plata, Argentina.

Buenos Aires State Award for Highest GPA, 1985.

Peer-Reviewed Publications

14000 citations - Google Scholar

H Index = 64 - Google Scholar

i10 index: 226 - Google Scholar

1. *Identifying a Loss-in-Weight Feeder Design Space Based on Performance and Material Properties*, Li, T, Scicolone, J., Sanchez., E., and Muzzio, F.J., J. Pharm. Innov. Doi.org/10.1007/s12247-019-09394-4

2. *Mixing Cell: A Device to Mimic Extent of Lubrication and Shear in Continuous Tubular Blenders*, Moghtadernejad, S., Escotet, S., Schafer, E., Muzzio, F.J. *AAPS Pharm. Sci. Tech.* **20**, 262 (2019)
3. *Continuous High Shear Granulation: Mechanistic Understanding of the Influence of Process Parameters on Critical Quality Attributes via Elucidating the Internal Physical and Chemical Microstructure*, Meng, W., Dvorak, J., Kumar, R., Hofmeister, R., Stepanek, F., Ramachandran, R., and Muzzio, F.J. *Adv. Powder tech.* **30**, 1765-1781, (2019).
4. *Prediction of dissolution profiles by non-destructive NIR spectroscopy in bilayer tablets*, Baranwal, Y., Roman, A., Keyvan, G., Ha, J.M., Hong, E.P., Muzzio, F.J., and Ramachandran, R.; *Int. J. Pharm* **565**, 419-436 (2019)
5. *Assessment of blend uniformity in a continuous tablet manufacturing process*, Sierra-Vega, N., Roman-Ospino, A., Scicolone, J., Muzzio, F.J., Romanach, R. Mendez, R. *International Journal of Pharmaceutics* **560**, 322-333, 2019.
6. *Effect of material properties on the residence time distribution (RTD) characterization of powder blending unit operations. Part II of II: Application of models*, Escotet-Espinoza, S., Oka, S., Wang, Z., Wang, Y., Roman-Ospino, A., Schafer, E., Cappuyns, P., VanAssche, I., Futran, M., Muzzio, F.J., Ierapetritou, M. *Powder Technology* **344**, 525-544, 2019.
7. *Effect of tracer material properties on the residence time distribution (RTD) of continuous powder blending operations. Part I of II: Experimental evaluation* Escotet-Espinoza, S., Moghtadenejad, S., Oka, S., Wang, Y., Roman-Ospino, A., Schafer, E., Cappuyns, P., VanAssche, I., Futran, M., Ierapetritou, M., Muzzio, F.J., *Powder Technology* **342**, 744-763, 2019.
8. *Modeling the effects of material properties on tablet compaction: A building block for controlling both batch and continuous pharmaceutical manufacturing processes* Escotet-Espinoza, S., Vadodaria, S., Singh, R., Muzzio, F.J., Ierapetritou, M., *Int. J. Pharmaceutics*, **543**, 274-287, 2019.
9. *Modeling fluidized bed impregnation of active pharmaceutical ingredients onto porous excipients*, Grigorov, P, Muzzio, F.J., Glasser, B. J., *Chem. Eng. Sci.* **202**, 36-54, 2019
10. *A comprehensive analysis and optimization of continuous twin-screw granulation processes via sequential experimentation strategy*, Meng, W., Suparna Rao, K., Snee, R.D., Ramachandran, R., Muzzio, F.J., *Int. J. Pharmaceutics*, **556**, 349-362, 2019
11. *Measurement of the residence time distribution of a cohesive powder in a flighted rotary kiln*, Paredes, I.J., Yohannes, B., Emady, H., Muzzio, F.J., Maglio, A., Borghard, W.G., Glasser, B.J., Cuitino, A.M., *Chem. Eng. Sci.* **191**, 56-66, 2018
12. *Advanced process design and understanding of continuous twin-screw granulation via implementation of in-line process analytical technologies*, Meng, W., Roman-Ospino, A., Panikar, S. S., O'Callaghan, C.O., Gilliam, S.J., Ramachandran, R., Muzzio, F.J., *Adv. Powder Tech* **30**, 879-894, 2019
13. *Manufacturing of Pharmaceuticals by Impregnation of an Active Pharmaceutical Ingredient onto a Mesoporous Carrier: Impact of Solvent and Loading*, Thamer A Omar¹, Sarang Oka², Fernando J. Muzzio² and Benjamin J. Glasser . *Journal of Pharmaceutical Innovation*, 1-12 (2018)
14. *A "Large-N" Content Uniformity Process Analytical Technology (PAT) Method for Phenytoin Sodium Tablets*, Pawar, P., Talwar, S., Reddy, D., Bandi, C. K., Wu, H., Sowrirajan, K., Friendman, R., Drazer, G, Drennen, J.K., and Muzzio, F.J., *J. Pharm Sci.* doi.org/10.1016/j.xphs.2018.06.031
15. *Using a material property library to find surrogate materials for pharmaceutical process development*, Escotet-Espinoza, S., Moghtadernajad, S., Scicolone, J., Wang, Y., Pereira, G., Schafer, E., Klingeleers, D., Ierapetritou, M., and Muzzio, F.J., *Powder Technology* **339**, 659-676 (2018)

16. *Measurement of the Residence Time Distribution of a Cohesive Powder in a Flighted Rotary Kiln*, Paredes, I., Yohannes, B., Emady, H., Muzzio, F.J., Maglio, A., Borghard, W., Glasser, B., Cuitino, A., Chem. Eng. Science 191, 56-66 (2018)
17. *Cross-sectional analysis of impregnated excipient particles by energy dispersive X-ray spectroscopy*. Grigorov, P., Glasser, B., Muzzio, F.J., <https://doi.org/10.1016/j.powtec.2018.03.062>
18. *A drop penetration method to measure powder blend wettability*. Wang, Y., Liu, Z., Muzzio, F.J., Drazer, G., Callegari, G. International Journal of Pharmaceutics 538, 112-118
19. *Combined feedforward/feedback control of an integrated continuous granulation process*, Pereira, G.C., Muddu, S.V., Román-Ospino A. D., Clancy, D., Igne, B., Airiau, C., Muzzio, F.J., Ierapetritou, M., Ramachandran, R., Singh, R., doi.org/10.1007/s12247-018-9347-8
20. *A Training on: Continuous Manufacturing (Direct Compaction) of Solid Dose Pharmaceutical Products*. Moghtadernejad, S., Escotet-Espinoza, S., Oka, S., Singh, R., Liu, Z., Román-Ospino, A. D., Li, T., Razavi, S., Panikar, S., Scicolone, J., Callegari, G., Hausner, D., Muzzio, F. Journal of Pharmaceutical Innovation 13, 155–187 (2018)
21. *Modeling the Effects of Material Properties on Tablet Compaction: A building block for controlling both batch and continuous pharmaceutical manufacturing processes*. Escotet-Espinoza, MS., Vadodaria, S. Muzzio, FJ., Ierapetritou, MG. International Journal of Pharmaceutics, 543, Issues 1–2, 274-287, (2018).
22. *Methods and Tools for Design Space Identification in Pharmaceutical Development*. Boukouvala, F., Muzzio, FJ, MG Ierapetritou, MG. Comprehensive Quality by Design for Pharmaceutical Product Development and Manufacture, 95-123 (2017).
23. *Controlled Shear System and Resonant Acoustic Mixing Effects on Lubrication and Flow Properties of Pharmaceutical Blends* Y. Wang, J. G. Osorio, T. Li, F. J. Muzzio. Powder Technology **322**, 332-339 (2017).
24. *Analysis of the origins of content non-uniformity in high shear wet granulation*. Oka S., Smrčka D., Kataria A., Emady H., Muzzio F., Štěpánek F., and Ramachandran R. Submitted to International Journal of Pharmaceutics, International Journal of Pharmaceutics, Volume **528**, Issue 1-2, 578-585 (2017).
25. *Effects of process and design parameters on granule size distribution in a continuous high shear granulation process*. Wei Meng, Sarang Oka, Xue Liu, Thamer Omer, Rohit Ramachandran, Fernando J. Muzzio. DOI: 10.1007/s12247-017-9288-7 Journal of Pharmaceutical Innovation (2017)
26. *The Effect of Operating Conditions on the Residence Time Distribution and Axial Dispersion Coefficient of a Cohesive Powder in a Rotary Kiln*. Ingrid Paredes, Bereket Yohannes, Heather Emady, Benjamin Glasser, William Borghard, Fernando Muzzio, Alberto Cutino, Jean Beeckman, Samia Illias, Paul Podsiadlo, Eric Jezek, Joseph Baumgartner. Chemical Engineering Science 158, 50-57 (2017).
27. *Capillary drop penetration method to characterize the liquid wetting of powders*, Z. Liu, Y Wang, F. Muzzio, G. Callegari, G. Drazer, Langmuir, 33 (1), pp 56–65 (2017).
28. *Diminished Segregation in Continuous Powder Mixing*. S. Oka, A., Sahay, W. Meng and F. Muzzio. Powder Technology 309:79-88 (2017).
29. *Predicting feeder performance based on material flow properties*. Yifan Wang, Tianyi Li, Ben Glasser and Fernando Muzzio, Powder Technology. 308:135-148. (2017)
30. *Near Infrared Spectroscopic Calibration Models For Real Time Monitoring Of Powder Density*. Román-Ospino, A. D., Singh, R., Ierapetritou, M., Ramachandran, R. Méndez, R., Ortega, C., Muzzio, F. J., Románach, R. J.. International Journal of Pharmaceutics, International Journal of Pharmaceutics **512**, 61-74 (2016)

31. *Effect of resonant acoustic mixing on pharmaceutical powder blends and tablets.* J.G. Osorio, K. Sowrirajan, F.J. Muzzio, *Advanced Powder Technology* 27 1141-1148 (2016).
32. *Enabling real time release testing by NIR prediction of dissolution of tablets made by Continuous Direct Compression (CDC).* P. Pawar, Y. Wang, G. Keyvan; G. Callegari, A. Cuitino, F. Muzzio. *International Journal of Pharmaceutics* **512**, 96-107 (2016)
33. *Effects of processing parameters and blade patterns on continuous pharmaceutical powder mixing.* J.G. Osorio, F.J. Muzzio. *Chemical Engineering and Processing: Process Intensification* 109 59-67 (2016).
34. *Prediction of Conductive Heating Time Scales of Particles in a Rotary Drum,* Heather N. Emady, Kellie V. Anderson, William G. Borghard, Fernando J. Muzzio, Benjamin J. Glasser, Alberto Cuitino, *Chemical Engineering Science*, 152(2), 54-54 (2016).
35. *Scaling of heat transfer and temperature distribution in granular flows in rotating drums.* B. Yohannes, H. Emady, K. Anderson, I. Pareders, M. Javed, W Borghard, B.J. Glasser, F.J. Muzzio, and A.M. Cuitino. *Phys. Rev. E* 94(4) 042902 (2016).
36. *Statistical analysis and comparison of a continuous high shear granulator and a twin screw granulator: effect of process parameters on critical granule attributes and granulation mechanisms,* Wei Meng, Lalith Kotamarthy, Savitha Panikar, Maitraye Sen, Shankali Pradhan, Michaelis Marc, James D. Litster, Fernando J. Muzzio, Rohit Ramachandran. Submitted to *International Journal of Pharmaceutics* 513 (1-2) pp.357-375 (2016).
37. *A novel consolidation method to measure powder flow properties using a small amount of material,* S Koynov, FJ Muzzio, BJ Glasser, *AIChE Journal*, 62, 4193-4200 (2016).
38. *Improving Dissolution Kinetics of Pharmaceuticals by Fluidized Bed Impregnation of Active Pharmaceutical Ingredients,* Plamen Grigorov, Benjamin Glasser, and Fernando J. Muzzio, *AIChE J.* 62, 4201-4214 (2016).
39. *The effect of mechanical strain on properties of lubricated tablets compacted at different pressures,* P. Pawar, H. Joo, G. Callegari, G. Drazer, A. Cuitino, and F. J. Muzzio, *Powder Technology* 301, 657-664 (2016).
40. *Statistical comparison of dissolution profiles.* Y. Wang, R. D. Snee, G. Keyvan, F.J. Muzzio. *Drug development and industrial pharmacy* 42.5: 796-807 (2016).
41. *Prediction of Dissolution Profiles by Non-Destructive Near Infrared Spectroscopy in Tablets Subjected to Different Levels of Strain.* E. Hernandez, P. Pawar, G. Callegari, Y. Wang, N. Velez, G. Keyvan, B. Michniak, , F. Muzzio, A. Cuitiño, and R. J. Romañach. *Journal of Pharmaceutical and Biomedical Analysis* 117, 568-576 (2016).
42. *The effect of Shear applied during pharmaceutical process on near infrared spectra.* Eduardo Hernandez, Pallavi Pawar, Sandra Rodriguez, Sergiy Lysenko, Fernando Muzzio, Rodolfo Romanach, *Applied Spectroscopy* 70 455-466 (2016).
43. *Effect of Liquid Addition on the Bulk and Flow Properties of Fine and Coarse Glass Beads,* James Scicolone, Benjamin Glasser, and Fernando Muzzio, *AIChE Journal* 62, 648–658 (2016).
44. *Micro-mixing dynamics of active pharmaceutical ingredients in bin-blending,* J. Osorio, G. Stuessy, G. Kemeny, and F.J. Muzzio, *Chemical Engineering and Processing: Process Intensification*, 102, 141-155 (2016).
45. *Measurement of the Axial Dispersion Coefficient of Powders in a Rotating Cylinder: Dependence on Bulk Flow Properties,* Sara Koynov, Yifan Wang, Fernando Muzzio; Benjamin Glasser, *Powder Technology* 292 298–306 (2016)
46. *Predicting Flow Behavior of Pharmaceutical Blends Using Shear Cell Methodology: A Quality by Design Approach,* Yifan Wang, Wei Meng, Ronald D. Snee, Fernando J. Muzzio, *Powder Technology* 294 (2016)

47. *Perspectives in the continuous manufacturing of powder-based pharmaceutical processes* Marianthi Ierapetritou, Fernando Muzzio, and Gintaras Reklaitis, *AIChE J.* 62, 1846–1862 (2016)
48. *Characterization of Resonant Acoustic Mixing using Near-Infrared Chemical Imaging*, Juan G. Osorio and Fernando J. Muzzio, *Powder Technology* 297, 349–356 (2016)
49. *Quantitative validation and analysis of the regime map approach for the wet granulation of industrially relevant zirconium hydroxide powders*, Manogna Adepu, Siddhi Hate, Angelique Bétard, Sarang Oka, Marek Schongut, Maitraye Sen, Yadvaindra Sood, Dorit Wolf, Stefan Wieland, Frantisek Stepanek, Fernando Muzzio, Benjamin Glasser, Rohit Ramachandran, *Powder Technology* 294, 177–184 (2016)
50. *A Method to Analyze Shear Cell Data of Powders Measured under Different Initial Consolidation Stresses*, Yifan Wang, Ben Glasser, and Fernando Muzzio, *Powder Technology* 294, 105-112 (2016).
51. *Flowsheet models to modernize pharmaceutical manufacturing design and risk assessment* Escotet-Espinoza, M.S., Singh, R., Sen, M., O’connor, T., Lee, S., Chatterjee, S., Ramachandran, R., Ierapetritou, M., Muzzio, F.J. *Pharmaceutical Technology* 39(4), pp. 34, (2015).
52. *Fit-for-purpose miniature NIR spectroscopy for solid dosage continuous manufacturing*, Karry, K.M., Singh, R., Muzzio, F.J., *American Pharmaceutical Review* 18 (4), 2015.
53. *A quantitative approach to understand raw material variability*, Koynov, S., Muzzio, F.J., *Methods in Pharmacology and Toxicology* 32, pp. 85, 2015.
54. *Advanced control of continuous pharmaceutical tablet manufacturing processes*, Singh, R., Velazquez, C., Sahay, A., Karry, K.M., Muzzio, F.J., Ierapetritou, M.G., Ramachandran, R., *Methods in Pharmacology and Toxicology* 32, pp. 191, 2015.
55. *Plant-Wide Control of a Continuous Tablet Manufacturing for Quality-By-Design Based Pharmaceutical Manufacturing*, Singh, R., Muzzio, F., Ierapetritou, M., Ramachandran, R., *Computer Aided Chemical Engineering* 37, pp. 2183, 2015.
56. *Evaluation of Resonant Acoustic Mixing Performance*, Juan G. Osorio and F.J. Muzzio, *Powder Technology*, 278 , pp. 46, 2015.
57. *A simple color concentration measurement technique for powders*, Emady, H.N., Wittman, M., Koynov, S., Borghard, W.G., Muzzio, F.J., Glasser, B.J., Cuitino, A.M., *Powder Technology* 286, pp. 392, 2015.
58. *Feedrate Deviations Caused by Hopper Refill of Loss-in-Weight Feeders*, *Powder Technology*, William Engisch and Fernando J. Muzzio, *Powder Technology* 283, pp. 389, 2015.
59. *Comparison of three rotational shear cell testers: Powder flowability and bulk density*, Koynov, S., Glasser, B., Muzzio, F., *Powder Technology* 283, pp. 103, 2015.
60. *Using Residence Time Distributions (RTDs) To Address The Traceability Of Raw Materials In Continuous Pharmaceutical Manufacturing*, William Engisch and Fernando Muzzio, *Journal of Pharmaceutical Innovation*, 11 64-81 (2016) DOI: 10.1007/s12247-015-9238-1.
61. *The Effects of Improper Mixing and Preferential Wetting of Active and Excipient Ingredients on Content Uniformity in High Shear Wet Granulation*, Sarang Oka, Heather Emady, Ondrej Kaspar, Viola Tokarova, Frantisek Stepanek, Fernando Muzzio and Rohit Ramachandran. *Powder Technology*, 278, 266–277 (2015).
62. *A combined feed-forward/feed-back control system for a QbD based continuous tablet manufacturing process*, Ravendra Singh, Fernando J. Muzzio, Marianthi Ierapetritou, Rohit Ramachandran, *Processes* 3(2), 339-356 (2015).
63. *Effects of mill design and process parameters in milling dry extrudates*. *Powder Technology* 278, pp. 84. A. Vanarase, R. Aslam, S. Oka, F. Muzzio, 2015.

64. *Loss-in-Weight Feeding Trials Case Study: Pharmaceutical Formulation*, W.E. Engisch, F. J. Muzzio. *Journal of Pharmaceutical Innovation*, 10, 56-75 (2015)
65. *A quantitative study of the effect of process parameters on key granule characteristics in a high shear wet granulation process involving a two component pharmaceutical blend* S. Oka, O. Kašpar, V. Tokárová, K. Sowrirajan, H. Wu, M. Khan, F. Muzzio, F. Štěpánek, R. Ramachandran. *Advanced Powder Technology*, Vol.26, No.1, 315-322, 2015.
66. *Assessment of Blend and Content Uniformity. Technical Discussion of Sampling Plans and Application of ASTM E2709/E2810*. *Journal of Pharmaceutical Innovation* DOI 10.1007/s12247-014-9208-z. James Bergum, Thomas Parks, James Prescott, Ravindra Tejwani, Jon Clark, William Brown, Fernando Muzzio, Samir Patel, Charles Hoiberg.
67. *Recommendations for the Assessment of Blend and Content Uniformity: Modifications to Withdrawn FDA Draft Stratified Sampling Guidance*. *J Pharm Innov* DOI 10.1007/s12247-014-9207-0, Thomas Garcia, James Bergum, James Prescott, Ravindra Tejwani, Thomas Parks, Jon Clark, William Brown, Fernando Muzzio.
68. *Characterization of Pharmaceutical Powder Blends Using In Situ Near-Infrared Chemical Imaging*. *Chemical Engineering Science* 108, 244–257, 2014. Juan G. Osorio, Gina Stuessy, Gabor J. Kemeny, Fernando J. Muzzio.
69. *Particle size segregation promoted by powder flow in confined space: The die filling process*, *Powder Tech*, 262, 215–222 (2014). D. Mateo, F. J. Muzzio, R. Méndez.
70. *A systematic framework for onsite design and implementation of a control system in the continuous tablet manufacturing process*. *Computers and Chemical Engineering* 66 (2014) 186–200. Ravendra Singh, Abhishek Sahay, Fernando J. Muzzio, Marianthi Ierapetritou, Rohit Ramachandran.
71. *Implementation of an advanced hybrid MPC–PID control system using PAT tools into a direct compaction continuous pharmaceutical tablet manufacturing pilot plant*. *International Journal of Pharmaceutics* 473 (2014) 38–54. Ravendra Singh, Abhishek Sahay, Krizia M. Karry, Fernando J. Muzzio, Marianthi Ierapetritou, Rohit Ramachandran.
72. *Effects of powder flow properties and shear environment on the performance of continuous mixing of pharmaceutical powders*, *Powder Technology*. 246, 63-72 (2013) Aditya U. Vanarase, Juan G. Osorio, Fernando J. Muzzio.
73. *Development of a methodology to estimate error in the in-line concentration measurements in a continuous powder mixing process*, *Powder Technology*. 241, 263–271 (2013). Aditya U. Vanarase, Maiju Jarvinen, Janne Paaso, Juan Osorio, Fernando Muzzio.
74. *Scale-up strategy for continuous powder blending process* *Powder Tech*. 235, 55-69, 2013, Y. Gao, F.J. Muzzio, M. Ierapetritou.
75. *Determination of Residence Time Distribution in Rotary Calciner*, *AIChE Journal*, 59(11), 4068- 4076, 2013. Y. Gao, B.L. Glasser, M.G. Ierapetritou, A. Cuitino, F.J. Muzzio, J. Beeckman, N. Fassbender, W. Borghard.
76. *Improving continuous powder blending performance using projection to latent structures regression*. *Journal of Pharmaceutical Innovation*, 8(2), 99-110, 2013. Y. Gao, F. Boukouvala, B. Engisch, W. Meng, F.J. Muzzio, M.G. Ierapetritou.
77. *Estimation of the confidence interval of the RSD measurement in pharmaceutical manufacturing*. *Journal of Pharmaceutical Innovation*, 8(2), 72-82, 2013. Y. Gao, M.G. Ierapetritou, F.J. Muzzio.
78. *Role of Consolidation State in the Measurement of Bulk Density and Cohesion*, *Powder Technology*. 239, 366-373 (2013) Alisa Vasilenko; Sara Koynov; Benjamin J Glasser; Fernando Muzzio.

79. *Fluidized Bed Drying of Pharmaceutical Materials: Moisture Measurement and Effects of Particle Size*, American Pharmaceutical Review, 4, (2013) Xue Liu, Fernando J. Muzzio, Johannes G. Khinast, Benjamin J. Glasser.
80. *Continuous direct tablet compression: effects of impeller rotation rate, total feed rate and drug content on the tablet properties and drug release*, DDIP, 39(11):1802-1808, 2013 M. Järvinen, J. Paaso, M. Paavola, K. Leiviskä, M. Juuti, F. Muzzio, K. Järvinen.
81. *Reduced-order discrete element method modeling*, Chemical Engineering Science, 95, 12-26, 2013 F. Boukouvala, Y. Gao, F. Muzzio, M.G. Ierapetritou.
82. *Effects of type of microcrystalline cellulose and blend flowability on the homogeneity of acetaminophen*. *Drug Development and Industrial Pharmacy* 39, 252-258, 2013. Marcos Llusá, Kalyana Pingali and Fernando J. Muzzio.
83. *Effects of powder flow properties on capsule filling weight uniformity*, *Drug Development and Industrial Pharmacy*. 39, 1464-1475, 2013. Juan G. Osorio and Fernando J. Muzzio.
84. *Quantitative on-line vs. off-line NIR analysis of fluidized bed drying with consideration of the spectral background*, *European Journal of Pharmaceutics and Biopharmaceutics*, **85**, 1064-1074, 2013, Nicolas Heigl, Daniel M. Koller, Benjamin J. Glasser, Fernando J. Muzzio, Johannes G. Khinast.
85. *Formulation and Manufacture of Pharmaceuticals by Fluidized Bed Impregnation of Active Pharmaceutical Ingredients onto Porous Carriers*. Plamen I. Grigorov, Benjamin J. Glasser and Fernando J. Muzzio, *AIChE Journal*, 59, 4538–4552, 2013.
86. *A review of the Residence Time Distribution (RTD) applications in solid unit operations*, *Powder Tech.* 228, 416-423, 2012, Y. Gao, F.J. Muzzio, M. Ierapetritou.
87. *Computational approaches for studying the granular dynamics of continuous blending processes - II: Population balance and data-based methods*, *Macromolecular Materials Engineering*, 297(1), 9-19, 2012. F. Boukouvala, R. Ramachandran, A. Dubey, A. Vanarase, F.J. Muzzio, M.G. Ierapetritou.
88. *An integrated approach for dynamic flowsheet modeling and sensitivity analysis of a continuous tablet manufacturing process*, *Computers and Chemical Engineering* 42, p. 30-47, 2012 F. Boukouvala, V. Niotis, R. Ramachandran, A. Vanarase, F.J. Muzzio, M.G. Ierapetritou.
89. *Effect Of Feed Frame Design And Operating Parameters On Powder Attrition, Particle Breakage, And Powder Properties*, *Powder Technology* 229, pp. 253–260, 2012, R. Mendez, C. Velazquez, and F. J. Muzzio.
90. *Periodic Section Modeling of Convective Continuous Powder Mixing Processes*. *AIChE Journal*. 58, pp. 69-78, 2012, Y. Gao, M. Ierapetritou, F.J. Muzzio.
91. *Automated Drop-on-Demand System with Real-Time Gravimetric Control for Precise Dosage Formulation*, *J Lab Autom.* doi: 10.1177/2211068211433398, 2012 A. Sahay, M. Brown, F. Muzzio, P. Takhistov.
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9. *Practical Powder Blending: Ingredient Agglomeration*. Tablets and Capsules, back cover, October 2014. F. J. Muzzio.
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12. *Model- predictive design, control and optimization of pharmaceutical process*. *PharmTech magazine Europe* 37 (6) (2013) 40-41. Fernando J. Muzzio, Ravendra Singh, Anwesha Chaudhury, Amenda Rogers, Rohit Ramachandran, Marianthi Ierapetritou (2013).
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15. *Flexible Multipurpose Continuous Processing of Pharmaceutical Tablet Manufacturing Process*. *GMP news, European Compliance Academic (ECE)*. http://www.gmp-compliance.org/daten/download/shortpaper_continuousprocessing_muzzio.pdf. Ravendra Singh, Fani Boukouvala, Eric Jayjock, Rohit Ramachandran, Marianthi Ierapetritou, Fernando J. Muzzio.
16. *Addressing Material Properties in the Design of a Direct Compression Continuous Manufacturing System*. *BioPharma Asia* 2 (3) (2013) 58-64. Sarang Oka, William Engisch, Fernando Muzzio.
17. *Continuous Powder Blenders for Pharmaceutical Application*. *Pharmaceutical Manufacturing*. 12 (8) (2013) 26-30. Sarang Oka, Fernando Muzzio.
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Patents

1. *Method and Apparatus for Particle Mixing*, U.S. Patent 5,884,999, 3/23/99, F.J. Muzzio, C. Wightman, P. R. Mort, and R. E. Riman.
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5. *Method of Improved Mixing in Roller Bottles*, U.S. Patent 6,096,544, 8/1/00, Joye L. Bramble, F.J. Muzzio, and James. A. Searles.
6. *Method of Improved Mixing of a Varicella-Infected Cell culture in Roller Bottles*, U.S. Patent 6,251,653, 6/26/01, Joye L. Bramble, F.J. Muzzio, and James. A. Searles.
7. *Powder sampling method and apparatus*, U.S. Patent 6,910,393, F.J. Muzzio, A. Alexander, D. Brone; and M. Roddy.
8. *Uniform Shear Application System and Methods Relating Thereto*, U.S. Patent 7,571,871, F.J. Muzzio, Lev Tsygan, Semen Dukler (22 claims)
9. *Uniform Shear Application System and Methods Relating Thereto*, U.S. Patent 7,918,410, F.J. Muzzio (sole inventor, 3 claims).
10. *Formulation and Manufacture of Pharmaceuticals by Impregnation onto Porous Carriers*, F. J. Muzzio, B. Glasser, and P. Grigorov, U.S. patent 10,004,682B2
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Book Chapters

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2. *Continuous Powder Mixing*, Osorio J.G., Vanarase A., Romañach R.J., Muzzio F.J., Ed: Dr. P. J. Cullen and C.D. Rielly. Wiley, 2015
3. *Powder Mixing*, McGraw Hill YearBook of Science and Technology 301-306 2014, J.G. Osorio and F.J. Muzzio.
4. *A Forward-Looking Approach to Process Scale-Up For Solid Dose Manufacturing*, in "Pharmaceutical Dosage Forms - Tablets Volume III" 3rd Edition, Stephen W. Hoag and Larry L. Augsburger Editors; Taylor and Francis (New York), F.J. Muzzio, M. Levin, K.R. Morris, M. Ierapetritou, P. Portillo, A. Alexander, M. Llusa, J.L.P. Soh, and R.J. McCann (2008) Pp 119-152.
5. *Powder Mixing Fundamentals*, in "Mixing Handbook of Science Technology," A. Alexander, T. Shinbrot and F.J. Muzzio, Handbook of Industrial Mixing, sponsored by the North American Mixing Forum, Copyright 2003 John Wiley and Sons, Inc., Published by John Wiley and Sons (2003)
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11. *Biophysics of Inhaled Drug Particles*, in "Inhalation Delivery of Therapeutic Peptides and Proteins" (A. Adjei and P. Gupta, Editors) Marcel Dekker Publishing Company, 27-58 (1997), A. Annapragada, P. Swanson, and F.J. Muzzio.
12. *Quantification of Mixing in Aperiodic Chaotic Flows*, in "Chaos Applied to Fluid Mixing" (reprinted from Chaos, Solitons, and Fractals, H. Aref and M.S. El Naschie, Editors) Pergamon, 125-149 (1995), M. Liu, F.J. Muzzio, and R.L. Peskin.
13. *Mixing as a Tool for Pollution Prevention*, in "Handbook of Industrial Pollution Prevention " (H. Freeman Editor) McGraw-Hill, 455-466 (1994), F.J. Muzzio and E.L. Paul.

Selected Mayor Teaching and Educational Activities

Director, Engineering Research Center on Structured Organic Particulate Systems. Responsible for the overall execution of the center, which includes planning, execution, and reporting of the ERC's research, educational, and technology innovation components. The program includes educational and outreach activities at the K-12, UG, graduate, and postgraduate levels spread across six universities (Rutgers, Purdue, NJIT, UPR, Rowan, and Univ. of Hawaii at Hilo).

Director, Pharmaceutical Engineering Program, Rutgers University, 1995-2006. In this capacity, founded the Rutgers Pharmaceutical Engineering Program, one of the first in the country, and designed and implemented a training curriculum, which culminated in the organization of a professional Masters degree, approved in 2010.

Director, NSF-NIH Nanopharmaceutical Engineering IGERT training program, 2005-2011. Led the team that applied for this IGERT grant, which was awarded and executed under my direction. In the context of this program, designed and led the implementation of a training curriculum in Pharmaceutical Nanotechnology that led to the training of 21 PhD students. In this context, lead the development of an 18-credit training program in Nanopharmaceutical Engineering, which required planning and specifying a number of courses, that have now been developed and implemented by several colleagues (Professors Muzzio, Sinko, Glasser, Tomassone, and Takistov)

Co-chair, education sub-committee of the National Institute for Pharmaceutical Technology and Education, 2005-2007. During this period, NIPTE articulated a National Educational Roadmap for rejuvenating education in Pharmaceutical Technology, centered around Masters degrees in Pharmaceutical Science and Education. This effort has resulted in the development of a recommended 36 credit-hour Master Curriculum in Pharmaceutical Engineering and Science that is currently nearing approval by key stake-holders (the 11 universities that comprised NIPTE at the time, the US FDA, and the pharmaceutical industry)

Founding Co-Chair, International Institute for Advanced Pharmaceutical Manufacturing, 2014-present. Together with Professor Alastair Florence, Director of CMAC, founded this

International Institute for Advanced Pharmaceutical Manufacturing that is jointly funded by the NSF (SAVI grant) and EPSRC of the UK. The institute has a dual education and research mission and is currently articulating an international curriculum in APM.

Online Implementation of Pharmaceutical Unit Operations graduate course. In 2013, implemented this course as an online teaching resource. This course was the first online course offered by the CBE department at Rutgers.

Seminars, Conferences, and Lectures

Academic

Pharmaceutical Manufacturing – form art to Science, Fernando J. Muzzio, a five day Course, Universidad Nacional del Sur, Bahia Blanca, Argentina, March 13-18, 2016

The Future of Pharmaceutical Manufacturing, a technical workshop, F. J. Muzzio Chair and organizer, Rutgers University, May 7, 2015

Achieving Excellence in Continuous Pharmaceutical Manufacturing, Advanced Manufacturing Workshop, University of Pennsylvania, May 2015

Multivariate Analysis in Continuous Pharmaceutical Manufacturing. QbD Symposium, DeMontfort University, UK, March 25, 2015

Continuous Pharmaceutical Manufacturing: The engineer's turn – Distinguished Speakers Series, University of Alberta, Edmonton, Alberta, March 2015.

Continuous Pharmaceutical Manufacturing: The "Late" Revolution, University of Pennsylvania, 3/18/14

Segregation (or Lack Thereof?) in the Continuous Mixing of Granular Materials. University of Florida at Gainesville, 4/1/14

Dissolution testing, an Engineer's perspective, University of Michigan, 8/4/2014

Effect of material properties on continuous pharmaceutical manufacturing (with a side of statistics) Duquesne University, School of Pharmacy, Pittsburgh, PA, January 2013

The physics of powders flow - dilation, segregation, and jamming - where is the math? New Jersey Institute of Technology Applied Math Colloquium, April 2013

Advances in Pharmaceutical Manufacturing: The Path Ahead, APV seminar on continuous manufacturing, University of Graz, Austria, Sept 26, 2012.

Engineering Methodologies for Integrated Design of Continuous Solid Dosage Manufacturing, APV seminar continuous manufacturing, University of Graz, Austria, Sept 26, 2012.

Continuous manufacturing: Interaction Effects Between Formulation Composition And Process Parameters on Product Properties, University of Heidelberg PAT/QbD conference, Heidelberg, Germany, Sept 26 2012.

Quantitative design of continuous mixing processes for pharmaceutical application, Graz University of Technology, Pharmaceutical Engineering Symposium, Sept 16, 2010

Pharmaceutical Engineering and the Quality-by-Design Initiative Keynote talk, Pharmaceutical Engineering Workshop, University of Graz, Austria, June 2007

Rheological Behavior of Cohesive Powders, Seminar at Purdue Univ., Chemical Engineering, October 6, 2006

Rheological Behavior of Cohesive Powders, Seminar at U. Maryland, Chemical Engineering, May 22, 2006

Cohesive Powder Flow and Mixing: Fundamentals and Applications, Seminar at UConn, School of Pharmacy, February 15, 2005

Quantification of cohesive effects in powder flow, Columbia University, Department of Chemical Engineering, January 2004

Mixing in Silico, Polytechnic University, Department of Chemical Engineering, October 2002

Mixing in Silico, Lehigh University, Department of Chemical Engineering, February 2002

Nanopharmaceutical Symposium, Rutgers University, November 2001

Analytical Methods for Granular Processes, Department of Chemical Engineering, Ohio State Univ., Columbus, OH, October 2001

Quantitative Analysis of Powder Blending Processes, Keynote talk, UK Particle Technology Forum, Univ. of Birmingham, United Kingdom, July 2001

Quantitative Analysis of Powder Blending Processes, Center for Advanced Food Technology, Rutgers University, April 2001

Quantitative Analysis of Powder Blending Processes. Department of Chemical Engineering, Univ. of Houston, Houston, TX, September 2000

Quantitative Analysis of Powder Blending Processes. Levich Institute, City College, CUNY, NY, September 2000

Training Session on Powder Mixing and Sampling, School of Pharmacy, Duquesne University, May 2000

Mechanism of Laminar Mixing in Stirred Tanks, Univ. of Oklahoma, Dept. Of Chemical Engineering, March 2000

Planar Laser Induced Fluorescence as a Method for Characterization of Fluid Mixing, Dantec Training Course, University of Miami, Oceanography Center, March 2000

Quantitative Analysis of Powder Blending and Sampling Processes Rutgers University, School of Pharmacy, Feb. 2000.

Quantitative Analysis of Powder Blending and Sampling Processes, Instituto de Catalisis y Petroleo, Universidad de Santa Fe, Argentina, 1998.

Granular Mixing, Dynamics Seminar (with Troy Shinbrot), University of Maryland, College Park, MD, January 1999

Development of Microstructure in 2D Chaotic Flows, Department of Physics, Univ. of Maryland, College Park, MD, January 1999

Quantitative Analysis of Powder Blending Processes, School of Chemical Engineering, Purdue Univ., West Lafayette, IN, September 1998

Quantitative Analysis of Powder Blending Processes, Dept. of Pharmaceutics, Univ. of Connecticut, Storrs, CT, December 1997

Mixing and Segregation in Granular Flows, Department of Chemical Engineering, University of Coimbra, July 1997.

Mixing and Segregation in Granular Flows, Department of Chemical Engineering, Florida State University, December 1996.

Mixing and Segregation in Granular Flows, Department of Chemical Engineering, University of Massachusetts, October 1996.

Mixing and Segregation in Granular Flows, Department of Chemical Engineering, University of Rome, September 1996.

Aperiodic Flow Perturbations: A Universal Route to Global Mixing? Princeton University, Princeton, NJ, November 1995

Aperiodic Flow Perturbations: A Universal Route to Global Mixing? NJIT, Newark, NJ, November 1995

Using Time-Dependent Flows to Enhance Mixing in Industrial Applications, Dept. of Chemical Engineering, City College, New York, NY, September 1995.

Suspension Dynamics: Three Applications, Dept. of Chemical Engineering, Ohio State University, Columbus, OH, May 1995.

Using Time-Dependent Flows to Enhance Mixing in Industrial Applications, Lehigh University, Dept. of Chemical Engineering, Bethlehem, PA, April 1995.

Using Time-Dependent Flows to Enhance Mixing in Industrial Applications, Columbia University, Dept. of Mechanical Engineering, New York, NY, March 1995.

Using Time-Dependent Flows to Enhance Mixing in Industrial Applications, Dept. of Chemical Engineering, Ohio State University, Columbus, OH, January 1995.

Enhancement of Mixing Using Time-Dependent Flows: From Theory to Applications, Department of Chemical Engineering, University of Pennsylvania, Philadelphia, PA, October 1994.

Chaotic Mixing of Powders, Department of Ceramics, Rutgers University, New Brunswick, NJ, February 1994

Applications of Chaotic Mixing, Dept. of Chem. Eng., University of Maryland, College Park, MD, October 1993.

Mixing of Granular Materials: Challenges and Opportunities, National Science Foundation workshop on Small Particle Sintering, Penn. State University, State College, PA, September 1993.

The Stretching Field in Periodic Cavity Flows, Polym. Proc. Institute, Stevens Inst. of Tech., Hoboken, NJ, July 1993.

Multifractal Techniques for the Analysis of Mixing in Chaotic Flows, Dept. of Chem. Eng., Univ. of Connecticut, Storrs, CT, September 1991.

Industrial, Federal, etc.

Continuous manufacturing of tablets and capsules - The Emerging Paradigm Fernando J. Muzzio, USP, Bethesda, MD, March 2016

Continuous Pharmaceutical Manufacturing, Thermo Fisher, Germany, October 15, 2015

Regulatory Issues Regarding Continuous Manufacturing, Fernando J. Muzzio, BMS, June 23, 2015

Integration of Compaction technology into continuous pharmaceutical manufacturing, Fette, Germany, May 26, 2015

C-SOPS Initiative in Continuous Pharmaceutical Manufacturing, GSK UK May 26, 2015

Continuous Processing of Solid Dosage Forms, Keynote Speaker, Inauguration of Bohle Continuous Manufacturing Facility - Germany, March 26, 2015.

Design and Implementation of Continuous Pharmaceutical Manufacturing Processes, a short course, Ghent University, Belgium, 4/28-30/2015

Achieving Excellence in Continuous Pharmaceutical Manufacturing, Astra Zeneca, UK, March 2015

Blend Uniformity Regulatory Support, a workshop for industry and FDA, Bethesda, MD, 9/17/2014

Opportunities in Continuous Manufacturing, FMC, Philadelphia, PA, 9/4/2014

Opportunities in Continuous Manufacturing, Lodige, Paddeborn, Germany, 9/8/2014

Opportunities in Continuous Manufacturing, Gericke, Zurich, Switzerland, 9/9/2014

Continuous Manufacturing – a Progress Report, Bosch, Stuttgart, Germany, 9/10/2014

Regulatory Issues in the Design and Implementation of Continuous Pharmaceutical Manufacturing Processes, Bulk and Powder Show, Chicago, IL, 6/5/14

Design and Implementation of Continuous Pharmaceutical Manufacturing Processes, a short course, King of Prussia, PA, 6/24-26/2014

Design and Implementation of Continuous Pharmaceutical Manufacturing Processes, a short course, San Juan, Puerto Rico, 3/2-3/6/2014

Fixing Blend Uniformity, a one-day workshop, San Juan, Puerto Rico, 3/7/14

Effects of material properties on the design of a direct compression continuous manufacturing system, PharmaTech Asia webinar. F. J. Muzzio, 1/16/2014.

Continuous Manufacturing: Current State of Technology and Research Needs. Fernando Muzzio, NIPTE conference, Bethesda, MD, June 2013.

Continuous Pharmaceutical Manufacturing, Fernando J. Muzzio, Drug Information Agency Annual Meeting, Washington, DC, April 2013 DIA

New processes in response to cost pressures: The Current Situation of Continuous Processing & PAT in Pharmaceutical Production, Fernando Muzzio, ISPE – DACH (Hamburg, Germany) April 18, 2013

Design and Implementation of Continuous Pharmaceutical Manufacturing Processes, a Mixing Consultants 3-day course, Zurich, Switzerland, Dec 12-14 2012.

Powder-based Continuous Manufacturing at Rutgers, Haldor Topsoe, Copenhagen, Denmark, Dec 11, 2012.

Powder-based Continuous Manufacturing, Glatt Seminar at Rutgers, December 4, 2012.

Design and Implementation of Continuous Pharmaceutical Manufacturing Processes, a Mixing Consultants 3-day course, Nov 28-30 2012, Bethesda, MD.

Invited talk: *Effects on ResonantAcoustic® Mixing on Final Blend Material Properties*, Juan G. Osorio and Fernando J. Muzzio. The Art and Technology of ReasonantAcoustic® Industrial Mixing, Butte, MT, August 2012.

The Engineering Research Center on Structured Organic Particulate Systems – Collaborations with the US Army. Wright Paterson Air Force Research Center, Dayton, Ohio, July 25, 2012.

Meeting Data Capture and Materials Traceability Requirements in Continuous Manufacturing, Werum User Group Meeting, Morristown, NJ, May 4, 2012.

Powder-based manufacturing, P&G, Newcastle, UK, April 24 2012.

Optimizing Powder Flow Properties in Capsule Filling Applications Capsugel, Boston, MA, March 1 2012.

QbD and PAT methods for Continuous Manufacturing, FDA ODG Silver Spring, MD, February 27, 2012.

Advancements in Pharmaceutical Manufacturing, Fernando Muzzio, Mixing Consultants Course, Singapore, 10/3 to 10/5/11

Challenges of Statistical Analysis/Control in a Continuous Process, Fernando Muzzio PQRI workshop on Sample Sizes for Decision Making in New Manufacturing Paradigms, 9/12 to 9/14/11

Advancements in Pharmaceutical Manufacturing, Fernando Muzzio, Mixing Consultants Course, Dublin, Ireland, 9/4 to 9/8 2011

Blend Uniformity, Fernando Muzzio PQRI workshop on Sample Sizes for Decision Making in New Manufacturing Paradigms, 9/12 to 9/14/11

Acoustic Mixing of Pharmaceutical blends, Fernando Muzzio and Juan Osorio Conference on acoustic mixing of energetic materials, Resodyn Corporation, Butte, MN, 7/13/11

Design and Scale Up of Rotary Calciners, Fernando Muzzio, Alberto Cuitino, Silvina Tomassone, Atul Dubey, Yijie Gao, ExxonMobil, 5/23/2011

Characterizing blend uniformity: Thief sampling, stratified sampling and PAT, What to choose, and why, Fernando Muzzio, FDA, Bethesda, MD, 5/10/11

Effect of electrostatics on flow properties of powder blends, Fernando Muzzio, FDA, Bethesda, MD, 2/25/11

Quality by Design - a one-day course, Fernando Muzzio, Sunovion Pharmaceuticals, Osaka, Japan 2/5/2011

API Impregnation as a new platform for highly potent compounds, Fernando Muzzio BMS, 2/1/11, New Brunswick, NJ.

Advances in Pharmaceutical Process Design, a short course by Mixing Consultants, Helsinki, Finland, December 8-10, 2010

Design of Compression Systems (a one-day course) presented at Haldor Topsoe, Dec. 6, 2010

Advances in Pharmaceutical Process Design, a short course by Mixing Consultants, Bethesda, MD, October 27-29, 2010

Design of Continuous Pharmaceutical Manufacturing Processes, Glatt GmbH, Weimar, Germany, October 21, 2010

Design of continuous secondary manufacturing - engineering challenges, Novartis, Basel, Switzerland, Aug. 27, 2010

Design of Continuous Pharmaceutical Manufacturing Processes, Boehringer Ingelheim, Danbury, CT, July 24, 2010

Discrete Element Modeling of Pharmaceutical Processes, US. FDA, Silver Spring, MD, July 13, 2010

Blending and Flow of Pharmaceutical Powders, a short course by Mixing Consultants, San Juan, PR, May 26-28, 2010

The effect of blend microstructure on macroscopic properties: Flow, Hydrophobicity, Electrostatics, US. FDA, Silver Spring, MD, May 10, 2010

Getting to Grips with Quality by Design, Tim Freeman and Fernando Muzzio, Interphex 2010, April 20, 2010

Blending and Flow of Pharmaceutical Powders, a short course by Mixing Consultants, Pearl River, NJ Feb 23-25, 2010

Pharmaceutical Powder Processing, Short Course, Fernando Muzzio, Medtronic Corporation, Twin cities, December 2009

Blending and Flow of Pharmaceutical Powders, a short course by Mixing Consultants, Graz University of Technology, Graz, Austria, NJ, December 9-11, 2009

Advantages and Design of Continuous Manufacturing Methods, Fernando Muzzio, Glaxo-SmithKline, Valley Forge, PA, November 2009

Continuous Mixing of Liquid-liquid and Liquid-solid Systems, Fernando Muzzio, Covidien, NJ, October 2009

Pharmaceutical Unit Operations – a Short Course, Fernando Muzzio, Merck, Puerto Rico, June 2009-April 2010

Continuous Manufacturing, Fernando Muzzio, Boehringer Ingelheim, Danbury, CT, June 2009

Effect of Powder Flow Properties on Capsule Filling, Capsugel, Greenville, NC, May 2009

Effect of Powder Flow Properties on Capsule Filling, Pfizer, Freiburg, Germany, May 2009

Pharmaceutical Technology School, a short course by Mixing Consultants, San Juan, PR, April 27-May 1, 2009

Effects of Shear and Strain on Critical Properties of Pharmaceutical Blends, Fernando Muzzio, Wyeth, Pearl River, NY, December 9, 2008.

Pharmaceutical Technology School, a short course by Mixing Consultants, Weehawken, NJ, October 6-10, 2008

Engineering Approach to Pharmaceutical Scale-up, Validation, Optimization & Control: Application to Continuous Manufacturing, Fernando Muzzio, invited talk presented at the 47th Eastern Pharmaceutical Technology Meeting, Somerset, NJ, September 2008.

Implementing a QbD approach (for solid dose products), invited talk presented at the PharmaEd Resources Workshop, Philadelphia, PA, May 29, 2008

Pharmaceutical Technology School, a short course by Mixing Consultants, San Juan, Puerto Rico, May 19-23, 2008

Pharmaceutical Solid Dose Manufacturing, a short course, Apotex, Toronto, Canada, March 6&7, 2008

Pharmaceutical Process Improvement and Quality by Design, a short course by Mixing Consultants, Philadelphia, Pennsylvania, October 15-17, 2007

Powder flow and Blending, presented at Pfizer, Groton, CT, September 2007

Quality by Design approach for blending processes, presented at Vertex, Cambridge, MA, September 2007

Quality by Design approach for blending processes, presented at Cephalon, Malvern, PA, September 2007

Quality by Design and Process Analytical Technologies: Natural Approaches for Continuous Processing – Keynote Lecture - Presented at the Pharmaceutical Technology Annual Event, Philadelphia, July 2007

Quality by Design and Process Analytical Technologies: Natural Approaches for Continuous Processing – Keynote Lecture - Presented at the Pharmaceutical Technology Annual Event, Philadelphia, July 2007

Powder Processing, a two day primer, presented at ILC Dover, Frederica, DE, July 2007

Excellence & Innovation in Pharmaceutical Development and Manufacturing F. J. Muzzio. Presented at the “The Path to Innovation: Scientific Discovery and Learning,” the 13th Annual Coalition for National Science Foundation Exhibition and Reception, U.S. Congress, June 26, 2007.

Quality by Design approaches for dissolution control, Pharmaceutical Education Resources Dissolution Testing Conference, Philadelphia, June 25, 2007

Assessment of Hydrodynamic effects in Dissolution Testing, Pharmaceutical Education Resources Dissolution Testing Conference, Philadelphia, June 25, 2007

Quality by Design approaches for dissolution control, invited talk, United States Pharmacopeia, Research Consortium Meeting June 11, 2007

Critical variables in powder flow and mixing: cohesion, dilation, and electrostatics Presented at GSK, June 2007

Pharmaceutical Engineering and the Quality-by-Design Initiative Keynote talk, Pharmaceutical Engineering Workshop, Graz, Austria, June 2007

Powder compaction, Granulation, and Blending – 2-day short course, Presented at Haldor-Topsoe, Denmark, June 2007

Critical variables in powder flow and mixing: cohesion, dilation, and electrostatics Presented at Pfizer, May 2007

Pharmaceutical Process Improvement and Quality by Design, 3-day short course, presented in San Juan, Puerto Rico, April 2007

Electrodynamic Behavior of Pharmaceutical Powders, presented at Pfizer- Peapack, NJ, March 2007

Defining QbD: Integrating Quality-by-Design Across Development, Scale-up, and Manufacturing – Invited keynote lecture, Pharma Edge Annual Event, Atlanta, Georgia, Jan. 2007

Defining QbD: Using Model-based Methodologies to Design, Optimize, and Control Pharmaceutical Products and Processes, presented at the US FDA, December 2006

Understanding Overlubrication, presented at Boehringer - Ingelheim, December 2006

Using DEM to Design Granular Flow Systems, presented at ExxonMobil, November 2006

Pharmaceutical Process Improvement and Quality by Design: Blending, Granulation, Compaction, and Coating. A 3-day course presented in San Francisco, CA, November 2006

Rheological Behavior of Cohesive Powders ONR, June 22, 2006

Defining Quality by Design: Model-based Design of Pharmaceutical Products and Processes Keynote Lecture Presented at the World Trade Group Global Pharmaceutical Summit, September 2006

Blend Uniformity – a Quality by Design Approach, Presented at the Foss-NIR Users Group meeting, September 2006

Flow Properties of Pharmaceutical Materials: Dilation, Shear, Electrodynamics Presented at Merck, July 2006

A QbD approach for dissolution testing Presented at the CHPA Industry-FDA workshop, Chicago, June 2006

Blend Uniformity – A QbD approach. Presented at the Pharmaceutical Technology Annual Meeting June 2006

Model Based Design, Optimization, and Control of Pharmaceutical Products and Processes Keynote Lecture Presented at Pharmaceutical Technology Annual Meeting June 2006

Model Based Design, Optimization, and Control of Pharmaceutical Products and Processes Presented at “Surviving the PAT Revolution – a Tunnell Symposium, Manhattan, NY, May 2006

Powder Properties – Effects on Blending and handling (and further downstream), presented at NIST, April 2006

Pharmaceutical Unit Operations – a 3 day course – presented at Pfizer, Sandwich, UK, March 2006

Pharmaceutical Technology school – a 5 day course – coordinated and presented – Mahwah, NJ March 2006

Failure Modes in Blending Scale Up – Glatt Pharmaceutical Technology Conference, Plainfield, NJ, October 2005

Modeling Pharmaceutical processes, Pharmaceutical Engineering Symposium. University of Puerto Rico at Mayaguez, October 2005

Developing meaningful manufacturing controls Presented at FDA “ORA University” August 2005

CFD modeling of Reactive Laminar Flows, Invited talk, ISCRE meeting Barsa, Italy June 2005

Pharmaceutical Technology school – a 5 day course – coordinated and presented – San Jan, Puerto Rico, March 2005

Pharmaceutical Engineering Education: New Opportunities for the Pharmaceutical Industry and its Engineering Workforce. Pharmaceutical Engineering Symposium. University of Puerto Rico at Mayaguez, December 2004

Quantification of Powder Flow, Pfizer, Peepack, NJ, Dec 2004

Sampling, Blending, Lubrication, Scale-up, and Segregation of Pharmaceutical Materials - a two day Course Toronto, CA, Dec 2004

Systematic Optimization of Pharmaceutical Products and Processes, FDA Science Forum, Bethesda, MA, October 2004

Systematic Optimization of Pharmaceutical Products and Processes, Aspen World, Orlando, FL, October 2004

Multivariate blend modeling, Glatt Air Workshop, October 2004

Hydrodynamic Effects in the USP II apparatus, J&J, Raritan, NJ, September 2004

Multivariate blend modeling, Sepracor, Washburn, MA, September 2004

Systematic Optimization of Pharmaceutical Products and Processes, Powrex, Osaka, Japan, August 2004

Model-Based Optimization of Pharmaceutical Products and Processes, FDA Science Forum on the Critical Path, Washington, DC, June 2004

Understanding Lubrication, Merck, West Point, PA, April 2004

Quantification of cohesive effects in powder flow, Pfizer, Ann Arbor, MI, March 2004

Powder mixing- a two day course, San Juan, PR, March 2004

Model-Based Optimization of Pharmaceutical Products and Processes, European Arden House, London, UK, March 2004

Model-Based Optimization of Pharmaceutical Products and Processes, GSK, London, UK, March 2004

Model-Based Optimization of Pharmaceutical Products and Processes, IFPAC, DC, January 2004

Model-Based Optimization of Pharmaceutical Products and Processes, Arden House, NY, January 2004

Hydrodynamic Effects in the USP II apparatus, BSM, New Brunswick, NJ, November 2003

Nanopharmaceutical Products and Processes, FDA Science Forum, Rockville, MD, August 2003

Powder mixing- a two day course, San Juan, PR, March 2003

Optimization of Pharmaceutical Products and Processes, J&J Beerse (Belgium), January 2003

Systematic Design and Optimization of Mixing Processes in Coating Pan, M&M Mars, Hackettstown, NJ January 2002

Design of Powder Mixing Processes in Bin Blenders, McNeil Consumer Products, Valley Forge, PA, January 2002

Design of Powder Mixing Processes in Bin Blenders, Merck, West Point, PA, January 2002

Training Session on Powder Blending and Liquid Mixing, Wyeth-Ayerst Laboratories, Rouses Point, NY January 2002

Rational Approached to Tablet Dissolution, Wyeth-Ayerst Laboratories, Pearl River, NY December 2001

Analysis and Design of Pharmaceutical Blending and Sampling Processes, Wyeth-Ayerst Laboratories, Pearl River, NY November 2001

Training Session on Powder Blending and Liquid Mixing, ICI, Teeside, UK, October 2001

Design of Powder Mixing Processes in Bin Blenders, GEA Gallay Ltd, Birmingham, UK, October 2001

LIF, CFD, and Such, Dantec Dynamics, Copenhagen, Denmark, October 2001

Analysis and Design of Pharmaceutical Blending and Sampling Processes, J&J Corporate-Wide Training Session on Formulation Development, Princeton, NJ, Sept. 2001

Design of Powder Mixing Processes in Bin Blenders, Pfizer, Morris Plains, NJ, August 2001

Analysis and Design of Pharmaceutical Blending and Sampling Processes, Wyeth-Ayerst Laboratories, Richmond, VA, July 2001

Short Course on Liquid and Powder Mixing, Industrial Research Limited, Lower Hutt, New Zealand, June 2001

Analysis and Design of Pharmaceutical Blending and Sampling Processes, Novartis, East Hannover, NJ, May 2001

Analysis and Design of Pharmaceutical Blending and Sampling Processes, Purepac, Elizabeth, NJ, April 2001

Quantitative Analysis of Powder Blending and Sampling Processes, Natural Alternatives International, Carlsbaad, CA, March 2001

Quantitative Analysis of Powder Blending and Sampling Processes, International Institute for Research, Coral Gables, FL, February 2000

Training Session on Powder Mixing and Sampling, Johnson and Johnson, Raritan, NJ, June 2000

Training Session on Powder Mixing and Sampling, Johnson and Johnson, Caguas, PR, June 2000

Mixing in Rotary Calciners, ExxonMobil, Pulsboro, NJ, June 2000

Using asymmetric designs to enhance de-airation of stirred tanks, Colgate, Piscataway, NJ, May 2000

Quantitative Analysis of Powder Blending and Sampling Processes Glaxo-Wellcome, Rayleigh, NC, May 2000

Real-Time CFD Methods for Flow and Mixing Applications, Catalytica, Mountain View, CA, April 2000.

Real-Time CFD Methods for Flow and Mixing Applications, P&G, Cincinnati, OH, March 2000.

Real-Time CFD Methods for Flow and Mixing Applications, Chemineer, Dayton, OH, March 2000.

Quantitative Analysis of Powder Blending and Sampling Processes McNeil Consumer Products, Forth Washington, PA, March 2000

A New CFD Approach for Reactive Flow Applications, Merck, Rahway, NJ, Jan. 2000.

Mixing in Bin Blenders, Apotex, Toronto, CA, January 1999.

Quantitative Analysis of Powder Blending and Sampling Processes FDA, Rockville, MD, Jan. 2000

Mixing in Tote Blenders, Schering, Kenilworth, NJ, Dec. 1999.

Quantitative Analysis of Powder Blending and Sampling Processes Warner Lambert, Morris Plains, NJ, Dec. 1999.

CFD analysis of the SMX Static Mixer, Koch Industries, Wichita, KS, Nov. 1999

Quantitative Analysis of Powder Blending and Sampling Processes, Glaxo Wellcome, Toronto Canada, July 1999.

Quantitative Analysis of Powder Blending and Sampling Processes, Ely Lilly, Toronto Canada, July 1999.

Real-Time CFD Methods for Flow and Mixing Applications, Exxon, Clinton, NJ, April 1999.

Quantitative Analysis of Powder Blending and Sampling Processes Merck, Rahway, NJ, July 1999.

Quantitative Analysis of Powder Blending and Sampling Processes, Union Carbide, Bound Brook, July 1999.

Quantitative Analysis of Powder Blending and Sampling Processes Watson Pharmaceutical Laboratories, Los Angeles, CA, June 1999.

Real-Time CFD Methods for Flow and Mixing Applications, Exxon, Clinton, NJ, April 1999.

Quantitative Analysis of Powder Blending and Sampling Processes McNeil Consumer Products, Valley Forge, PA, March 1999.

Quantitative Analysis of Powder Blending and Sampling Processes Dupont, Wilmington, DE, March 1999.

A New CFD Approach for Reactive Flow Applications, Dupont, Wilmington, DE, March 1999.

Mixing in Bin Blenders, Apotex, Toronto, CA, January 1999.

Quantitative Analysis of Powder Blending and Sampling Processes, JRH Biosciences, Lancaster, PA, Dec. 1998.

Quantitative Analysis of Powder Blending and Sampling Processes, Philadelphia Pharmaceutical Forum (Featured Speaker), Dec. 1998.

Development of CFD tools for Mixing Analysis, Fujitsu, Palo Alto, CA, December 1998

Quantitative Analysis of Powder Blending and Sampling Processes, Energy Research Corporation, Danbury, CT, December 1998.

Short Course on Liquid and Solid Mixing Technology, Glaxo-Wellcome, Verona, Italy, October 1998

Enhancing Industrial Mixing Systems, Nabisco, Morristown, NJ, October 1998

Quantitative Analysis of Powder Blending and Sampling Processes, Glaxo-Wellcome, Toronto, Canada, October 1999.

Quantitative Characterization of Fluid Mixing Processes, Roche, Belvedere, NJ, Sept. 1998.

Shape-Induced Segregation of Powders, Pfizer, Groton, CT, September 1998.

Quantitative Analysis of Powder Blending and Sampling Processes, Jenike and Johanson, Boston, MA, August 1998.

Quantitative Analysis of Powder Blending and Sampling Processes, Rohm and Haas, Spring House, PA, June 1998.

Quantitative Analysis of Powder Blending and Sampling Processes, Dupont Pharmaceutical Company, Wilmington, DE, June 1998.

Quantitative Analysis of Powder Blending Processes, Warner Lambert, Vega Baja, PR, May 1998.

Quantitative Analysis of Powder Blending Processes, Schein Pharmaceuticals, Caguas, PR, May 1998.

Quantitative Analysis of Powder Blending Processes, Specialty Minerals, Bethlehem, PA, May 1998.

Quantitative Analysis of Powder Blending Processes, Apotex, Toronto, Canada, April 1998.

Quantitative Characterization of Mixing Processes in Industrial Applications, Dow Chemical Company, Klute, TX, April 1998

Quantitative Characterization of Mixing Processes in Industrial Applications, Rohm and Haas, Spring House, PA, N.J, February 1998

Quantitative Characterization of Mixing Processes in Industrial Applications, Parke-Davis, Morristown, N.J, February 1998

Quantitative Characterization of Mixing Processes in Industrial Applications, Schering-Plough, Kenilworth, N.J, January 1998

The Role of High Performance Computations on the Analysis and Prediction of Mixing Processes, DOE Symposium, Bethesda, MD, January 1998

Quantitative Analysis of Powder Blending Processes, Merck, West Point, PA, December 1997.

Enhancement of Industrial Powder Blending Processes, Procter & Gamble, Cincinnati, Ohio, September 1997

Quantitative Analysis of Powder Blending Processes, Tor Pharm, Toronto, Canada, September 1997.

Mixing: A Short Course, Sequus, Palo Alto, CA, June 1997

Quantitative Characterization of Mixing Processes in Industrial Applications, Procter & Gamble, Cincinnati, Ohio, May 1997

Powder Blending Processes: A Training Session, Merck, Dorado, PR, April 1997

Mixing: A Short Course, Union Carbide, Bound Brook, NJ, March 1997

Design of Aerosol Production Systems, Abbott, North Chicago, IL, November 1996

Powder Blending Processes: A Training Session, Bristol-Myers Squibb, New Brunswick, NJ, October 1996

Powder Blending Processes: A Training Session, Merck, West Point, PA, September 1996

Quantitative Analysis of Powder Blending Processes, Patterson Kelley, East Strousbourg, PA, August 1996.

Quantitative Characterization of Mixing Processes in Static Mixers, Dupont, Wilmington, DE, August 1996

Powder Mixing and Segregation: A Tutorial, Procter and Gamble, Cincinnati, OH, August 1996

Development of Pharmaceutical Excipients with Tailored Mechanical Properties, National Starch and Chemical Company, Bound Brook, NJ, July 1996

Analysis of Segregation Processes in Industrial Blending Operations, Dexter, Olean, NY, June 1996

Analysis of Segregation Processes in Industrial Blending Operations, Unilever, Hoboken, NJ, May 1996

Analysis of Segregation Processes in Industrial Blending Operations, Abbott, North Chicago, IL, April 1996

Mixing of Light Powders in Heavy Liquids, Abbott, North Chicago, IL, April 1996

Aerosol Dynamics: a Quantitative Approach, Abbott, North Chicago, IL, April 1996

Powder Mixing and Sampling: A Critical Review of the Barr Decision, Bristol-Myers Squibb, East Brunswick, NJ, March 1996

Quantitative Analysis of Powder Blending Processes, General Electric, Parkersburg, WV, February 1996.

Powder Mixing and Sampling: A Critical Review of the Barr Decision, PDA, Bethesda, MD, January 1996

Using Time-Dependent Flows to Enhance Mixing in Industrial Systems, Union Carbide, Bound Brook, NJ, January 1996.

Powder Mixing and Sampling: A Critical Review of the Barr Decision, Ganes Chemicals, Carlstadt, NJ, October 1995

Using Time-Dependent Flows to Enhance Mixing in Industrial Systems, Colgate, Piscataway, NJ, September 1995.

Powder Mixing and Sampling: A Critical Review of the Barr Decision, Abbott, North Chicago, IL, August 1995

Quantitative Analysis of Powder Blending Processes, Patterson-Kelley, East Stroudsburg, PA, August 1995.

Powder Mixing and Sampling: A Critical Review of the Barr Decision, Merck, White House, NJ, August 1995

Using Time-Dependent Flows to Enhance Mixing in Industrial Systems, Lightnin, Rochester, NY, August 1995.

Using Time-Dependent Flows to Enhance Mixing in Industrial Systems, National Starch, Bridgewater, NJ, August 1995.

Using Time-Dependent Flows to Enhance Mixing in Industrial Systems, Dupont, Wilmington, DE, June 1995.

Using Time-Dependent Flows to Enhance Mixing in Industrial Systems, Merck Research Laboratories, Rahway, NJ, June 1995.

Using Time-Dependent Flows to Enhance Mixing in Industrial Systems, Merck Manufacturing Division, West Point, PA, June 1995.

Using Time-Dependent Flows to Enhance Mixing in Industrial Systems, Abbott Laboratories, N. Chicago, IL, May 1995.

Quantitative Analysis of Powder Blending Processes, Pfizer, Mystic, CN, April 1995.

Quantitative Analysis of Powder Blending Processes, Schein Pharmaceuticals, Danbury, CT, April 1995.

Quantitative Analysis of Powder Blending Processes, Abbott Laboratories, N. Chicago, IL, March 1995.

Quantitative Analysis of Powder Blending Processes, Schering-Plough, Kenilworth, NJ, February 1995.

Quantitative Analysis of Powder Blending Processes, Procter and Gamble, Norwich, NY, February 1995.

Deposition of Solid Particles in Cascade Impactors, Abbott Laboratories, N. Chicago, IL, February 1995.

Using Chaos to Enhance Mixing in Industrial Systems, Hoechst-Celanese Co., Charlotte, NC, February 1995.

Using Time-Dependent Flows to Enhance Mixing in Industrial Systems, Mobil Oil, Paulsboro, NJ, February 1995.

Chaotic Mixing of Powders and Slurries, Hoechst-Celanese Co., Summit, NJ, November 1994

Using Chaos to Enhance Mixing in Industrial Systems, Hoechst-Celanese Co., Corpus Christi, TX, October 1994.

Enhancing Mixing in Stirred Vessels, Exxon Research and Engineering Co., Clinton, NJ, June 1994.

Efficient Mixing of Fluids, Powders, and Slurries: Applications for the Chemical Industry, 3M, Saint Paul, MN, March 1994.

Quantitative Characterization of Powder Blending Processes, Dow Chemical Company, Midland, MI, February 1994.

Mixing of Granular Materials: Opportunities for Technology Development, National Starch and Chemical Company, Edison, NJ, December 1993.

Efficient Mixing of Granular Heterogeneous Materials, Pfizer Inc., Mystic, CT, October 1993.

Using Effective Mixing to Enhance Performance in Pharmaceutical Systems, Merck Sharp and Dohme Company, West Point, PA, September 1993.

Chaotic Mixing: Applications for Materials Manufacturing, Raychem Corporation, Palo Alto, CA, September 1993.

Efficient Mixing of Solids and Slurries, Battelle-Pacific Northwest Laboratories, Richland, WA, September 1993.

Using Mixing to Prevent Waste in Chemical Reactors, Battelle-Pacific Northwest Laboratories, Richland, WA, September 1993.

Practical Applications of Chaotic Mixing, DuPont Company, Wilmington, DE, May 1993.

Effective Mixing of Powders and Slurries, Merck Sharp and Dohme Company, Whitehouse Station, NJ, May 1993.

Chaotic Mixing, Concepts and Applications, Exxon Research and Engineering, Clinton, NJ, February 1993.

Transport and Reactions in Multiphase Systems, United States Geological Survey, Trenton, NJ, December 1992.

Chaotic Mixing of Fluids, Particulate Solids, and Suspensions, M&M Mars, Hackettstown, NJ, December 1992.

An Integrated Experimental/Computational Approach For the Analysis of Reactive Systems, Mobil Chemical Company, Edison, NJ, October 1992.

Transport, Reaction, and Structure Evolution in Complex Reactive Systems, Exxon Research and Engineering Company, Florham Park, NJ, July 1992.

A Combined Image Analysis / Monte Carlo / Finite Differences Approach to Reactive Systems, Merck Sharp and Dohme Laboratories, Rahway, NJ, May 1992.

Simultaneous Diffusion, Reaction, and Convection in Partially Mixed Fluid Systems, Exxon Research and Engineering Company, Clinton, NJ, February 1992.

Some Applications of Chaos and Fractals in Engineering, Dept. of Mechanical Engineering, Rutgers University, Piscataway, NJ, December 1991.

Papers Presented at Major Technical Meetings

Advanced Pharmaceutical Manufacturing: Small Molecules, Fernando J. Muzzio, IFPAC 2016, Arlington, VA, January 2016

Materials Characterization and Formulation Space Mapping for Continuous Manufacturing – IFPAC 2016, Arlington, VA, January 2016

Achieving Excellence in Continuous Pharmaceutical Manufacturing, EPTM meeting, Morristown, NJ, Sept 25, 2015

A Novel Method to Analyze Shear Cell Data of Powders for Different Initial Consolidation Stresses, Yifan Wang, Sara Koynov, Benjamin J. Glasser and Fernando J. Muzzio, AIChE Annual Meeting, Salt Lake City, UT, November 2015

Measurement of Residence Time in Calcination Processes, Ingrid J. Paredes, Bereket Yohannes, Heather N. Emady, Benjamin Glasser, William G. Borghard, Fernando J. Muzzio and Alberto Cuitiño, AIChE Annual Meeting, Salt Lake City, UT, November 2015

Predicting Temperature Distributions in Rotary Calciners By Thermo-Mechanical DEM, Bereket Yohannes, Heather N. Emady, Ingrid J. Paredes, William G. Borghard, Fernando J. Muzzio,

Benjamin Glasser and Alberto Cuitino, AIChE Annual Meeting, Salt Lake City, UT, November 2015

ERC-SOPS - a Pre-Competitive Model for Strategically-Driven Research and Technology Development and Commercialization, Fernando J. Muzzio, M. Sebastian Escotet-Espinoza, Zilong Wang and Marianthi Ierapetritou, AIChE Annual Meeting, Salt Lake City, UT, November 2015

Effects of Operating Parameters on Tablet Quality in a Continuous Manufacturing Line, Golshid Keyvan, Xue Liu, Sonia Razavi, Alberto Cuitiño and Fernando J. Muzzio, AIChE Annual Meeting, Salt Lake City, UT, November 2015

Measuring Blend Hydrophobicity By Single Droplet Penetration Technique, Yifan Wang, Zhanjie Liu, Gerardo Callegari, German Drazer and Fernando J. Muzzio, AIChE Annual Meeting, Salt Lake City, UT, November 2015

Improving Dissolution Kinetics of Pharmaceuticals By Fluidized Bed Impregnation, Plamen I. Grigorov, Benjamin J. Glasser and Fernando J. Muzzio, AIChE Annual Meeting, Salt Lake City, UT, November 2015

Comparison of Continuous High Shear Granulation Processes with Twin-Screw Wet Granulation, Wei Meng, Sarang Oka, Savitha Panikar, Rohit Ramachandran and Fernando J. Muzzio, AIChE Annual Meeting, Salt Lake City, UT, November 2015

Characterization and Modeling of Feeders: A Critical Component in Continuous Pharmaceutical Manufacturing Process, M. Sebastian Escotet-Espinoza, Eric Jayjock, Ravendra Singh, Aditya Vanarase, Fernando J. Muzzio and Marianthi Ierapetritou, AIChE Annual Meeting, Salt Lake City, UT, November 2015

Flowsheet Modeling for Oral Solid Drug Product Manufacturing, Zilong Wang, M. Sebastian Escotet-Espinoza, Ravendra Singh, Fernando J. Muzzio and Marianthi Ierapetritou, AIChE Annual Meeting, Salt Lake City, UT, November 2015

Dynamic Modeling and Advanced Control of Tablet Press, Ravendra Singh, M. Sebastian Escotet-Espinoza, Shishir Vadodaria, Jun Zhang, Fernando J. Muzzio, Rohit Ramachandran and Marianthi Ierapetritou, AIChE Annual Meeting, Salt Lake City, UT, November 2015

A Systematic Approach of Using Material Properties Data for Pharmaceutical Process Simulation, Jun Zhang, Frances Pereira, Ravendra Singh, Sean Bermingham, Rohit Ramachandran, Fernando J. Muzzio and Marianthi Ierapetritou, AIChE Annual Meeting, Salt Lake City, UT, November 2015

Design of Continuous Manufacturing Systems – a 12 Step method, Douglas Hausner, Marianthi Ierapetritou, and Fernando Muzzio, Rutgers University, IFPAC 2015, Arlington, VA

An Online Method for Continuously Monitoring Powder Density, Abhishek Sahay, Ravendra Singh, Rohit Ramachandran, and Fernando Muzzio, IFPAC 2015, Arlington, VA

Use of continuous powder density measurement for feed-forward control of tablet presses, Ravendra Sing, Abhishek Sahay, Rohit Ramachandran, and Fernando Muzzio, IFPAC 2015, Arlington, VA

A QbD Study of Continuous High Shear Granulation, Wei Meng, Xue Liu, and Fernando Muzzio, IFPAC 2015, Arlington, VA

Experimental and Modeling Study of Powder Segregation in the Feeding Tube of a Tablet Press, Sarang Oka and Fernando Muzzio, IFPAC 2015, Arlington, VA

Development of a PAT Tool for Monitoring Individual Layer Thickness of Bilayer Tablets by Terahertz Time Domain Measurement, Wang Y., Heaps D., Cuitino A., Muzzio F.J., International Diffuse Reflectance Conference, Chambersburg, PA, Aug. 2 - 8, 2014

Real time prediction of powder density in a continuous manufacturing line, Román Ospino A. D., Singh R., Ramachandran R., Ierapetritou M., Sahay A., Oka S., Liu X., Muzzio F., Romanach R., International Diffuse Reflectance Conference, Chambersburg, PA, August 2- 8, 2014.

Prediction of Dissolution Profiles by Different Levels of Strain, Hernandez E., Pawar P., Muzzio F.J., Romanach R.J., International Diffuse Reflectance Conference, Chambersburg, PA, Aug. 2 - 8, 2014

Real Time Release of Pharmaceutical Tablets and Oral Films. Karry K.M., Acevedo D., Susarla R., Krull S., Sievens L., Michniak-Kohn B., Dave R. N., Bilgili E. A., Romañach R. J., Ierapetritou M., Cuitiño A., and Muzzio F. J., NY/NJ Society for Applied Spectroscopy Student Night Event, Piscataway, NJ, February 26, 2014.

Interaction of Material Properties and Process Parameters in Continuous Manufacturing, Sara Koynov, Amanda Rogers, Krizia Karry, Sarang Oka, Abhishek Sahay, Fernando Muzzio, IFPAC, 1/21/2014

Segregation (or lack thereof) in continuous granular flow Sarang Oka, Krizia Karry, Fernando Muzzio IFPAC, 1/21/2014

Traceability of Raw Materials in Pharmaceutical Continuous Manufacturing, William Engisch and Fernando Muzzio IFPAC, 1/21/2014

Design and Operation of Continuous Rotary Calciners, Emady H.N., Anderson K.V., Glasser B.J., Muzzio F.J., Borghard W.G., Cuitino A., 7th World Congress on Particle Technology, Beijing, China, May 19-22, 2014.

Achieving Excellence in Continuous Manufacturing, PQRI/FDA symposium on Continuous Manufacturing, 9/16/2014

Using Flowsheet Modeling to Achieve Excellence in Continuous Manufacturing, IFPAC Europe, Cortona, Italy, Sept. 30 2014

Effect of Resonant Acoustic Mixing on Pharmaceutical Blends and Tablets, J.G. Osorio, K. Sowrirajan, and F.J. Muzzio, AIChE Annual Meeting, Atlanta, GA, November 2014

Effect of Resonant Acoustic Mixing on Pharmaceutical Blends and Tablets, Osorio J.G., Sowrirajan K., and Muzzio F.J., AIChE Annual meeting, Atlanta, GA, November 17-21, 2014.

Axial Dispersion Coefficient of Mixing in Dilute Systems, Sarang Oka, Sara Koynov, and Fernando Muzzio, AIChE Annual Meeting, Atlanta, GA, November 17-21, 2014.

Parametric Study of Powder Flow (quasi-static bed) Down a Vertical Pipe, Sarang Oka, Abhishek Sahay, and Fernando Muzzio, AIChE Annual Meeting, Atlanta, GA, November 17-21, 2014.

Traceability of Raw Materials in Pharmaceutical Continuous Manufacturing”, William Engisch and Fernando Muzzio, IFPAC, Arlington, VA, January 24, 2014.

Characterization and Modeling of Continuous Processing Unit Operations with Experimentally Measured Residence Time Distributions (RTD), William Engisch and Fernando Muzzio, AIChE Annual Meeting, Atlanta, GA, November 17-21, 2014.

Interaction of Material Properties and Process Parameters in Continuous Manufacturing, Sara Koynov, Amanda Rogers, Krizia Karry, Sarang Oka, Abhishek Sahay, Fernando Muzzio, IFPAC, Arlington, VA, January 24, 2014.

A novel method to measure powder flow properties using a small amount of material, Sara Koynov, James Scicolone, Benjamin Glasser, Fernando Muzzio, AIChE Annual Meeting, Atlanta, GA, November 17-21, 2014.

Statistical Meaningful Comparison of Dissolution Profiles. Yifan Wang, Ronald D. Snee, Fernando J. Muzzio. AAPS Annual Meeting and Exposition, San Diego, CA, November 2-6, 2014.

Continuous High Shear Wet Granulation: Impact of Process and Design Parameters on Granule Properties, Wei Meng, Xue Liu and Fernando J. Muzzio, AIChE Annual Meeting, Atlanta, GA, November 17-21, 2014.

Continuous Wet Granulation: Impact of Process and Design Parameters on Granule Properties, Wei Meng, Xue Liu and Fernando J. Muzzio, AAPS Annual meeting, San Diego, CA, November 2-6, 2014.

- Design and Operation of Continuous Rotary Calciners*, H.N. Emady, K.V. Anderson, B.J. Glasser, F.J. Muzzio, W.G. Borghard, A. Cuitino, 7th World Congress on Particle Technology, Beijing, China, May 19-22, 2014.
- Optimization of Rotary Calcination Processes*, H.N. Emady, K.V. Anderson, I.J. Paredes, M. Wittman, B.J. Glasser, F.J. Muzzio, W.G. Borghard, A. Cuitino, AIChE Annual Meeting, Atlanta, GA, November 17-21, 2014.
- Effect of blend shearing and powder compaction on tablet properties*. Pallavi Pawar, Hee Joo, Chandrakant Bandi, Yifan Wang, Fernando Muzzio, Alberto Cuitino. AIChE Annual Meeting, Atlanta, GA, November 17-21, 2014.
- Modeling of Residence Time Distribution in Continuous Solid Oral Dose Manufacturing Processes*. Escotet-Espinoza, S., Rogers, A., Muzzio, F. and Ierapetritou, M.G. AIChE Annual Meeting. Atlanta, GA, 2014
- Advanced hybrid MPC-PID based closed-loop control of continuous pharmaceutical tablet manufacturing pilot-plant*, Singh R., Sahay A., Karry K.M., Sen M., Romañach R., Muzzio F., Ierapetritou M., Ramachandran R., IFPAC 2014, Arlington, VA (Washington DC), January 21-24, 2014.
- Plant-wide advanced hybrid model predictive closed-loop control of continuous pharmaceutical tablet manufacturing pilot-plant for QbD based manufacturing*, Singh R., Sahay A., Muzzio F., Ierapetritou M., Ramachandran R., AIChE annual meeting (739c), Atlanta, GA, November 16 – 21, 2014.
- Integrated dynamic real time optimization and advanced hybrid MPC-PID control of direct compaction continuous tablet manufacturing process*, Singh R., Sen M., Muzzio F., Ierapetritou M., Ramachandran R., AIChE annual meeting (668e), Atlanta, GA, November 16 – 21, 2014.
- Validation of Computational Codes*, F. J. Muzzio, AIChE Annual Meeting 2013, San Francisco, CA, November 2013
- Modeling of Heat Transfer in Rotary Calciners*, Kellie V. Anderson, Heather N. Emady, Benjamin J. Glasser, William G. Borghard, Alberto Cuitino, and Fernando J. Muzzio, AIChE 2013, San Francisco CA, November 2013.
- Use of Mechanistic Modeling to Understand Tablet Die Filling*, RJ Byron Smith, Atul Dubey, Fernando J. Muzzio and Damodaran Vedapuri, AIChE 2013, San Francisco CA, November 2013.
- Design and Operation of Continuous Rotary Calciners*, Heather N. Emady, Kellie V. Anderson, Benjamin J. Glasser, Fernando J. Muzzio, William G. Borghard, and Alberto Cuitino, AIChE 2013, San Francisco CA, November 2013.
- Parametric Analysis of Fluidized Bed Drying of Pharmaceutical Materials*, Xue Liu, Fernando J. Muzzio, Johannes G. Khinast, and Benjamin J. Glasser, AIChE annual meeting, San Francisco, CA, November, 2013.
- Study of Flow and Mixing in High Shear Mixers Using Numerical Techniques*, Atul Dubey¹, Fernando J. Muzzio² and Damodaran Vedapuri¹, AIChE annual meeting, San Francisco, CA, November, 2013.
- Micro-Mixing Characterization of Continuous Mixing Processes Using Near Infrared Chemical Imaging*, Juan G. Osorio, Eduardo Hernandez, Rodolfo Romañach, Fernando J. Muzzio, AIChE annual meeting, San Francisco, CA, November, 2013
- Measurement Of The Effect Of Total Shear and Compaction Force On Tablet Properties Using Terahertz Pulsed Spectroscopy: Towards The Prediction Of Dissolution Rate*, Pallavi Pawar, Mark Sullivan², David Heaps², Edward King², Yifan Wang³, Wiphusanee Dendamrongvit³, Alberto Cuitino⁴ and Fernando J. Muzzio, AIChE Annual Meeting, San Francisco CA, 2013.

Continuous Manufacturing Traceability for Pharmaceutical Products, William Engisch and Fernando Muzzio, AIChE Annual Meeting, San Francisco, CA, November 2013.

Traceability of Raw Materials in Pharmaceutical Continuous Manufacturing, William Engisch and Fernando Muzzio, AIChE Annual Meeting, San Francisco, CA, November 2013

Effect of Moisture Content on the Bulk and Flow Properties of Fine and Coarse Glass Beads, James V. Scicolone, Matthew J. Metzger, Kellie V. Anderson, Sara Koynov, Benjamin J. Glasser, and Fernando J. Muzzio, AIChE 2013, San Francisco, CA, November 2013

Measurement of the axial dispersion coefficient in a rotating cylinder: dependence on material properties, Sara Koynov, Benjamin Glasser, Fernando Muzzio, AIChE Annual Meeting, San Francisco CA, 2013.

The Effect of Blend Shearing and Compression On Dissolution Dynamics for Immediate Release Tablets, Gerardo Callegari, Tarek Awad, Yifan Wang, Pallavi Pawar, Wiphusanee Dendamrongvit, German Drazer, Fernando J. Muzzio and Alberto Cuitino, AIChE Annual Meeting, San Francisco CA, 2013.

Terahertz Pulsed Spectroscopy For Dissolution Prediction: Pallavi Pawar, Golshid Keyvan, Mark Sullivan, David Heaps, Edward King, Bo Michniak, Alberto Cuitino, Fernando Muzzio, AIChE Annual Meeting, San Francisco CA, 2013.

Introduction to Continuous Manufacturing, Krizia Kerry and Fernando Muzzio, AAPS 2013, San Antonio TX, November 2013

Terahertz Pulsed Spectroscopy For Dissolution Prediction: Pallavi Pawar, Golshid Keyvan, Mark Sullivan, David Heaps, Edward King, Bo Michniak, Alberto Cuitino, Fernando Muzzio, IFPAC 2014, Arlington, VA, January 2014

Traceability of Raw Materials in Pharmaceutical Continuous Manufacturing, William Engisch and Fernando Muzzio, IFPAC 2014, Arlington, VA, January 2014.

Design of PAT tool for real time determination of Blend Uniformity in Continuous Manufacturing. Sarang Oka, Krizia Kerry, and Fernando Muzzio, IFPAC 2014, Baltimore MD

Continuous Direct Compaction As a Manufacturing Route for Highly Segregating Blends, Sarang Oka, Abhishek Sahay, Fernando Muzzio, AIChE Annual Meeting, San Francisco, CA, November 2013.

Heat Transfer Scale-Up Laws Within a Rotary Calciner, Kellie V. Anderson, Heather N. Emady, Benjamin J. Glasser, William G. Borghard, Alberto Cuitino and Fernando J. Muzzio, AIChE Annual Meeting, San Francisco, CA, November 2013.

Design of An Interface for Integrating PAT Tools in Continuous Manufacturing for in-Line Real Time Sensing, Abhishek Sahay, Eric Jayjock, Eric Sanchez, Rodolfo J. Romañach, and Fernando J. Muzzio, AIChE Annual Meeting, San Francisco, CA, November 2013

Scale-Up of Continuous Rotary Calciners: Heat Transfer and Powder Flow, Heather N. Emady¹, Kellie V. Anderson¹, Benjamin J. Glasser¹, Fernando J. Muzzio¹, William G. Borghard¹ and Alberto Cuitino, AIChE annual meeting, San Francisco, CA, November, 2013.

Large n Sampling – an academic perspective, IFPAC 2013, Baltimore MD, January 2013.

Non-destructive methods for personalized capsule products, IFPAC 2013, Baltimore MD, January 2013.

Flowsheet Modeling Methods for Design and Optimization of Continuous Powder Processes, Fernando Muzzio, Fani Boukouvala, Ravendra Singh, Eric Jayjock, Marianthi Ierapetritou, and Rohit Ramachandran, IFPAC 2013, Baltimore MD, January 2013.

Powder Feeder Pairing with Downstream Continuous Mixer, William Engisch and Fernando J. Muzzio, IFPAC 2013, Baltimore MD, January 2013.

Optimal Operation and Advanced Control of a Flexible Multipurpose Continuous Pharmaceutical Tablet Manufacturing Process, Ravendra Singh, Fani Boukouvala, Eric Jayjock, Marianthi

Ierapetritou, Fernando Muzzio and Rohit Ramachandran, IFPAC 2013, Baltimore MD, January 2013.

Continuous Powder Blending with In-line NIR as a PAT Tool, Juan G. Osorio and Fernando Muzzio, IFPAC 2013, Baltimore MD, January 2013.

Building a Direct Compression Continuous Line - A Case Study, Eric Jayjock and Fernando Muzzio, IFPAC 2013, Baltimore MD, January 2013.

Manufacturing technologies and platforms for flexible manufacturing, AAPS Pre-Workshop on Patient-Centric Drug Delivery, Product Design and Development AAPS Annual Meeting, Chicago, IL, Oct 14 2012.

Bulk and Micro-Scale Characterization of Continuous Powder Blending Integrated with an Multi-Point in-Line NIR As a PAT Tool, Juan G. Osorio, William E. Engisch Jr. and Fernando J. Muzzio. American Institute of Chemical Engineering (AIChE) Annual Meeting, Pittsburgh, PA, October 2012.

Characterization of in-situ Near-Infrared Imaging to Aid Pharmaceutical Formulation Development, Juan G. Osorio, Gina Stuessy, Gabor J. Kemeny and Fernando J. Muzzio, AIChE Annual Meeting, Pittsburgh, PA, October 2012.

Determination of Residence Time Distribution in Rotary Calciner, Gao Y., A.M. Cuitino, B.J. Glasser, F.J. Muzzio, M.G. Ierapetritou, J.W. Beeckman, N.A. Fassbender, W.G. Borghard, AIChE Annual Meeting, Pittsburgh, PA, October 2012.

Effect of Water and Magnesium Stearate On the Strength of Ceramic Compacts, Sarang Oka, Alisar Tuncer, Alberto Cuititnio and Fernando Muzzio, AIChE Annual Meeting, Pittsburgh, October 2012.

Effect of Lubricant Mixing Time and Concentration, Compaction Speed and Compression Force On the Dissolution Profile of a Control Release Formulation, Sarang Oka, Pallavi Pawar, Fani Boukouvala and Fernando Muzzio, AIChE Annual Meeting, Pittsburgh, October 2012.

Powder Feeder Pairing with Downstream Continuous Blender, William E. Engisch, Fernando J. Muzzio, AIChE Annual Meeting, Pittsburgh, PA, October 2012.

From Experimental Data to Building Integrated Dynamic Flowsheet Models for Pharmaceutical Processes, F. Boukouvala, F. J. Muzzio and M. G. Ierapetritou, AIChE Annual Meeting, Pittsburgh, October 2012.

Blade Design Effect in Powder Phenomena and Residence Time Distribution Inside the Feed Frame, Fernando J. Muzzio, Daniel Mateo, Carlos Velázquez, Rafael Mendez, AIChE Annual Meeting, Pittsburgh, October 2012.

Effects of Particle Size and Particle Size Distribution On Fluidized Bed Drying of Pharmaceutical Materials, Fernando J. Muzzio, Johannes G. Khinast, Benjamin J. Glasser, Xue Liu, AIChE Annual Meeting, Pittsburgh, October 2012.

Continuous manufacturing: Interaction Effects Between Formulation Composition And Process Parameters on Product Properties, IFPAC Europe, Cortona, Italy, October 7 2012.

The Future of Solid Dose Manufacturing, panel discussion and podcast, Pharmaceutical Technology Forum, Interphex, NY, NY, May 1, 2012.

Segregation – background and case studies, Concert Pharma, Lexington, MA. July 5 2012.

Invited Talk: *Continuous Pharmaceutical Manufacturing Integrated with in-line NIR as a PAT Tool*, Juan G. Osorio, Jonathan Colon, Fernando J. Muzzio, International Diffuse Reflectance Conference (IDRC), Chambersburg, PA, July 2012.

Quality by Design: a progress report and a worked-out example in continuous processing Canadian Society of Pharmaceutical Scientists, Toronto, Canada, June 12 2012.

PAT for continuous secondary pharmaceutical manufacturing, APACT, Newcastle, UK, April 25 2012.

Real time monitoring of blend uniformity in a continuous powder mixing process, Aditya U. Vanarase¹, Janne Paaso², Maiju Järvinen³, Fernando J. Muzzio¹ IFPAC 2012, Baltimore, MD, January 2012.

Advanced Pharmaceutical Manufacturing, ACS and the Congress Series, Washington, DC, January 25, 2012.

PAT for continuous secondary pharmaceutical manufacturing, IFPAC 2012, Baltimore, MD, January 2012.

Dynamic Flowsheet Modeling Continuous Pharmaceutical Manufacturing, F. Boukouvala, V. Niotis, R. Ramachandran, F. J. Muzzio and M. G. Ierapetritou, Invited talk, IFPAC, Baltimore, January 2012.

Introduction to Discrete Element Models (invited talk), Fernando Muzzio, AAPS Annual Meeting, Washington, DC, October 2011

Introduction to Computational Fluid Mechanics (invited talk), Fernando Muzzio, AAPS Annual Meeting, Washington, DC, October 2011

Near-Infrared Spectroscopy for On-Line Drying End-Point Determination In a Small-Scale Fluidized Bed, Nicolas Heigl, Johannes G. Khinast, Benjamin Glasser and Fernando J. Muzzio, paper 68d, AIChE Annual Meeting, Minneapolis, MN, October 2011

Modeling and Sensitivity Analysis of Continuous Pharmaceutical Manufacturing, Fani Boukouvala, Vasilis Niotis, Lukasz Mioduszewski, Aditya U. Vanarase, Rohit Ramachandran, Fernando. J Muzzio and Marianthi G. Ierapetritou, paper 120c, AIChE Annual Meeting, Minneapolis, MN, October 2011

NAMF 21st Birthday Celebration: Challenge Problems In Fluid Mixing Technology (Invited talk) Richard V. Calabrese and Fernando J. Muzzio, paper 170d, AIChE Annual Meeting, Minneapolis, MN, October 2011

A QbD Approach to Improve Tablet Coating Uniformity, Atul Dubey, Fani Boukouvala, Golshid Keyvan, Richard Hsia, Kostas Saranteas, Dean Brone, Tushar Misra, Marianthi Ierapetritou and Fernando. J Muzzio, paper202f, AIChE Annual Meeting, Minneapolis, MN, October 2011

Relationship Between Material Properties and Structure of Nanocoated Organic Crystals, Kalyana C. Pingali, Adrian Mann, Troy Shinbrot and Fernando Muzzio, paper 341g, AIChE Annual Meeting, Minneapolis, MN, October 2011

Size Induced Segregation Inside the Feed Frame and During the Filling the Dies Using DEM Simulations, Daniel Mateo, Luis Obregon, Rafael Mendez, Carlos Velazquez, and Fernando. J Muzzio, paper 310g, AIChE Annual Meeting, Minneapolis, MN, October 2011

QbD Approaches for Continuous Manufacturing (invited talk), Fernando J. Muzzio, paper 407b, AIChE Annual Meeting, Minneapolis, MN, October 2011

Flow Properties Characterization for the Analysis of Catalyst Support Impregnation Process Performance, Alisa Vasilenko, Fernando J. Muzzio and Benjamin J. Glasser, paper 357d, AIChE Annual Meeting, Minneapolis, MN, October 2011

Effects of Mill Designs and Process Parameters In Milling of Alumina-Magnesia Extrudates, Fernando J. Muzzio and Aditya U. Vanarase, paper 397f, AIChE Annual Meeting, Minneapolis, MN, October 2011

Optimizing Continuous Powder Mixing Processes Using Periodic Section Modeling, Yijie Gao, Fernando. J Muzzio and Marianthi G. Ierapetritou, paper 506d, AIChE Annual Meeting, Minneapolis, MN, October 2011

Multivariate Analysis and Reduced Order Modeling Based On Discrete Element Method (DEM) Simulations for a Powder Blender, Yijie Gao, Fani Boukouvala, Fernando. J Muzzio and Marianthi G. Ierapetritou, paper 621c, AIChE Annual Meeting, Minneapolis, MN, October 2011

Fluidized Bed Drying of Pharmaceutical Powders and Granules, Xue Liu, Fernando J Muzzio, Johannes G. Khinast and Benjamin Glasser, paper 631i, AIChE Annual Meeting, Minneapolis, MN, October 2011

Resonant Acoustic (Vibratory) Powder Mixing Performance, Juan G. Osorio and Fernando J. Muzzio, paper 657 a, AIChE Annual Meeting, Minneapolis, MN, October 2011

Formulation and Manufacture of Pharmaceuticals by Fluidized Bed Impregnation of APIs Onto Porous Carriers, Plamen I. Grigorov, Benjamin J. Glasser and Fernando J. Muzzio, paper 666a, AIChE Annual Meeting, Minneapolis, MN, October 2011

Scaling up Strategy for Continuous Powder Mixing Process, Yijie Gao, Fernando J Muzzio and Marianthi G. Ierapetritou, paper 754f, AIChE Annual Meeting, Minneapolis, MN, October 2011

Continuous secondary pharmaceutical manufacturing, Fernando Muzzio, Interphex, March 2011, Manhattan, NY

PAT for continuous secondary pharmaceutical manufacturing, Fernando Muzzio, IFPAC, Jan. 2011, Baltimore, MD

Inversion of Andersen Cascade Impactor Data using the Maximum Entropy Method, Y. Gulak, E. Jayjock, F. Muzzio, P. McGlynn, A. Bauer, 29th Annual AAAR Conference (American Association of Aerosol Researchers), Portland, Oregon, November 2010

Effect of processing conditions on tablet content uniformity studied by X-Ray Tomography and Laser Induced Breakdown Spectroscopy, Atul Dubey, Daniel Braido, and Fernando Muzzio, AAPS annual meeting, New Orleans, LA, November 2010

Laser Induced Breakdown Spectroscopy as an Imaging Technique, Atul Dubey and Fernando Muzzio, AAPS annual meeting, New Orleans, LA, November 2010

Design Space of Pharmaceutical Processes Using Data-Driven Based Methods, F. Boukouvala, F. J. Muzzio and M. G. Ierapetritou, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Density Effects in Flow Properties Characterization of Powder Mixtures, A. Vasilenko, B. J. Glasser and F. J Muzzio, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Optimizing Powder Flow Properties in Capsule Filling Applications, J. G. Osorio, R. Mendez and F. J. Muzzio, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Spatial Arrangements of Organic Positions Due to Thin Film Nanosmearing Under Shear Environment, K. C. Pingali, R. Mendez, A. Cuitino and F. Muzzio, AIChE Annual Meeting: Salt Lake City, UT, November 8, 2010

Low Shear Continuous Tumble Mixing Characterization, L. G. Obregon-Quinones, R. Mendez, C. Velazquez, F. J. Muzzio, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Characterization of Flow Behavior of Binary Mixtures in a Rotational Shear Cell, A. Vasilenko, F. J Muzzio and B. J. Glasser, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Determination of the API Distribution in Tablets as a Result of Processing Parameters Using Laser Induced Breakdown Spectroscopy, D. Braido, A. Dubey, A. Cuitino and F. Muzzio

Periodic Section Modeling of Convective Continuous Powder Mixing Processes, Y. Gao, F. Muzzio, M. Ierapetritou, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Effect of Feed Frame Design and Operating Parameters On Powder Residence Time Distribution (RTD), L. G. Obregon-Quinones, C. Velazquez, F. J. Muzzio and M. Florian, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Hopper Refill of Loss-in-Weight Feeding Equipment, W. E. Engisch Jr. and F. Muzzio, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Lab Scale Modular Automated Drop On Demand System: Design Principle, M. Brown, F. Muzzio, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Comparative Evaluation of Drop On Demand Technologies for Micro Dispensing of Drug Formulations, A. Sahay, S. Holt, F. Muzzio and P. Takhistov, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Drop-On-Demand Dispensing of Pharmaceutical Suspensions: Correlation of Material Attributes and Operating Conditions to Process Performance, S. Holt, P. Takhistov, and F. Muzzio, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Application of Kriging for Dynamic Data-Driven Modeling of Pharmaceutical Processes, F. Boukouvala, F. J. Muzzio and M. G. Ierapetritou, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Characterization of Feeder Effects On Continuous Powder Mixing Using Fourier Series Analysis, Y. Gao, F. Muzzio, and M. Ierapetritou, AIChE Annual Meeting, Salt Lake City, UT, November 2010

QbD of Continuous Pharmaceutical Tablet Manufacturing, A. A. Koynov, A. U. Vanarase, W. E. Engisch Jr., A. Cuitino and F. Muzzio, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Effects of Material Properties in Continuous Mixing of Pharmaceutical Powders A. U. Vanarase, J. Osorio and F. J. Muzzio, and P. Takhistov, AIChE Annual Meeting, Salt Lake City, UT, November 2010

Diseño de Procesos Continuos de Manufactura Farmaceutica, VI Argentine Congress of Chemical Engineering, Mar del Plata, Argentina, Sept 26, 2010

Engineering Methodologies for Integrated Design of Continuous Solid Dose Manufacturing Systems, AAPS Workshop on Continuous Manufacturing, Baltimore, MD, Sept 20, 2010

A QbD Approach to Continuous Integrated Powder Feeding and Mixing, UK- PharmSci, Fernando J. Muzzio, Sept 3, 2010

Correlations Between Cab-O-Sil and MgSt Distribution and Dissolution of Pharmaceutical Tablets, Fernando J. Muzzio, CHISA 19, Prague, CZ, August 28, 2010

Experimental and Computational Characterization of Flow and Mixing Behavior in a Continuous Powder Mixer, Mixing XXII, Victoria, BC, Canada, August 2010

Quality by Design – a progress report, 4th European PAT Science Conference, Kuopio Finland, May 5, 2010

Electrostatics and cohesion: cause or effect? Fernando Muzzio, Invited talk, Powder flow 2009, London, UK, December 2009.

Method for Characterization of Loss-in-Weight Feeding Equipment, William Engisch and Fernando J. Muzzio, AIChE Annual Meeting, Nashville, Tennessee, November 2009.

Effect of Feed Frame Design and Operating Parameters on Powder Attrition, Particle Breakage and Powder Properties and Flow Properties, Mendez-Roman, R., Muzzio, F. J., and Velázquez, C., AIChE Annual Meeting, Nashville, Tennessee, November 2009.

Analysis of Electrical Properties of a Powder Blend on Flow Behavior: A QbD approach Muzzio, F. J., keynote presentation, session 52, AIChE Annual meeting, Nashville, Tennessee, November 2009.

Evaluation of Shear Induced Hydrophobicity and Drug Release, Pingali, K., Mendez-Roman, R., Muzzio, F. J., and Michniak, B., AIChE Annual Meeting, Nashville, Tennessee, November 2009.

Effects of Shear and Electrical Properties on Flow Characteristics of Pharmaceutical Blends, K. Pingali, M. S. Tomassone, F. Muzzio, AIChE Annual Meeting, Nashville, Tennessee, November 2009.

Characterizing Continuous Powder Mixing Using Residence Time Distribution, Y. Gao, A. Vanarase, F. Muzzio, M. Ierapetritou, AIChE Annual Meeting, Nashville, Tennessee, November 2009.

NIPTE-FDA Collaborative Case Study on Model-Based Design Space Development Across Scales and with Stability Considerations, G. Reklaitis, H. Arastoopour, R. Bogner, J. K. Drennen III, L. E. Kirsch, J. Litster, E. J. Munson, F. Muzzio, R. Suryanarayanan, S. Hoag, M. Khan, AIChE Annual Meeting, Nashville, Tennessee, November 2009.

The Development of Continuous Table Manufacturing Process Using Roller Compaction, M. Ye, R. Mcann, G.-Y. Fong, A. Giridhar, I. Hamdan, A. Vanarase, W. Engisch, M. Ierapetritou, F. Muzzio, G. Reklaitis, J. Litster, AIChE Annual Meeting, Nashville, Tennessee, November 2009.

Effect of Feed Frame Design and Operating Parameters on the Powder Hydrophobicity and Flow Properties, R. Mendez-Roman, F. Muzzio, C. Velazquez, AIChE Annual Meeting, Nashville, Tennessee, November 2009 .

Characterization of Lubrication in a Continuous Powder Mixer, A. Vanarase, M. Ierapetritou, F. Muzzio, AIChE Annual Meeting, Nashville, Tennessee, November 2009.

Shear and Flow Properties of Pharmaceutical Binary Mixtures, A. Vasilenko, F. Muzzio, B. J. Glasser, AIChE Annual Meeting, Nashville, Tennessee, November 2009.

Production of Pharmaceutical Nanoparticles Using An Environmentally-Safe Emulsion Template, F. Romanski, M. S. Tomassone, F. Muzzio, P. Takhistov, AIChE Annual Meeting, Nashville, Tennessee, November 2009 .

Analysis of the Effects of Shearing Conditions On the Distribution of MgSt Spectroscopy (NIR) Using Laser-Induced-Breakdown-Spectroscopy (LIBS) and near Infrared Spectroscopy, A. Vanarase, P. Brieva, F. Muzzio, AIChE Annual Meeting, Nashville, Tennessee, November 2009.

The Development of Methods to Link Design Space Models to Product Stability, Z. Zong, P. L. Wildfong, L. E. Kirsch, A. M. Kaushal, E. J. Munson, R. Suryanarayanan, D. H. Barich, K. Pingali, F. Muzzio, D. Kayrak-Talay, S. D. Desai and I. S. Buckner, AIChE Annual Meeting, Nashville, Tennessee, November 2009.

Predictive Modeling of Pharmaceutical Processes with Missing and Noisy Data, F. Boukouvala, F. Muzzio, M. Ierapetritou, AIChE Annual Meeting, Nashville, Tennessee, November, 2009.

Optimizing Powder Flow Properties for Capsule Filling Applications Juan Osorio, Rafael Mendez-Roman, and Fernando Muzzio, Annual Meeting, AAPS, Atlanta, GA, November 2009

Interaction Effects Between Formulation Composition and Process Parameters on Product Performance, Fernando Muzzio, Invited talk, ACS conference on Continuous Processing, Durham, NC, November 2009

Challenges in Continuous Manufacturing of Tablets, Fernando Muzzio, Invited talk, International Graz Congress for Pharmaceutical Engineering Graz, Austria September 17, 2009

Overview of the Engineering Research Center on Structured Organic Particulate Systems, Fernando Muzzio, Invited talk, Advanced Particle Technology Conference, New Delhi, India, September 2009

Optimizing Powder Flow Properties for Capsule Filling Applications, Juan Osorio, Rafael Mendez-Roman, and Fernando Muzzio, Advanced Particle Technology Conference, New Delhi, India, September 2009

Pharmaceutical Engineering Challenges and Opportunities Towards Continuous Manufacturing, Fernando Muzzio, Invited talk, World Congress in Chemical Eng, Montreal, Canada, August 2009

Using DEM for Pharmaceutical Process Design, Fernando Muzzio, Keynote Lecture, DEM Users Conference, Edinburg, Scotland, August 2009

A Quality by Design in Filling of Tablet Press Dies, Mendez-Roman, R., Muzzio, F.J., Velazquez, C., IFPAC/PAT/QbD Summit 2009, June 23-24, 2009, San Juan, PR.

Environmental impact of two emerging approaches: continuous manufacturing and personalized medicine, Fernando Muzzio, Invited talk, ACS conference on Green Chemistry, University of Maryland, Baltimore, June 2009.

Blend Formulation and Shear on Flow, Compression and Dissolution of Pharmaceutical Blends, Fernando Muzzio, Invited talk, Tablet tech conference, Cranbury, NJ, March 2009

A Study of Tablet Coating Uniformity Using LIBS, Atul Dubey, Patricia Portillo, Fernando Muzzio, and Martine Tourigny, Invited talk, presented at IFPAC, Baltimore, Maryland, January 2009.

Quality by Design: a Gap analysis, Fernando Muzzio, Invited talk, presented at IFPAC, Baltimore, Maryland, January 2009.

Electric effects in powder flow, mixing, and segregation, Invited talk, presented at INTERPHEX 2009, San Juan, Puerto Rico, January 2009.

Quantitative Design of Industrial Powder Mixing Systems NAMF Award lecture (Invited), Fernando J. Muzzio, AIChE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Study of the Variables Determining the Hydrophobicity of Lubricated Pharmaceutical Formulations Llusá, M., M. Kizilbash, H. Eichenblatt and F.J. Muzzio. American Association of Pharmaceutical Scientists (AAPS), Annual Meeting, Atlanta, Georgia. November 2008

Particle Technology Gaps of QbD (Invited), Fernando J. Muzzio, AIChE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Surface Tension in Pharmaceutical Manufacturing: An Overview and Two Case Studies (invited), Fernando J. Muzzio, M. Silvina Tomassone, Carlos Velázquez, Frank Romanski, Marcos Llusá, Wusheng Zhu, Rafael Mendez, AIChE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Computational Characterization of Continuous Mixers Using Discrete Element Modeling Techniques, Atul Dubey, Fernando J. Muzzio, AIChE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Analyzing the Data from An Anderson Cascade Impactor. A Computational Perspective, Yuriy Gulak, Eric Jayjock, Fernando J. Muzzio, AIChE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Shear and Composition Effects on the Flow and Electrostatic Properties of Pharmaceutical Powders, Alisa Vasilenko, Benjamin J. Glasser, Fernando J. Muzzio, AIChE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

An Observed Correlation Between Flow and Electrical Properties of Pharmaceutical Blends, Kalyana Pingali, Fernando J. Muzzio, Troy Shinbrot, AIChE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Production and Stabilization of Organic Crystalline Sub-Micron and Nanoparticles Using High Pressure Homogenization for Drug Delivery, Frank Romanski, M. Silvina Tomassone, Eric Jayjock, Fernando J. Muzzio, AIChE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Practical Methods for Improving Flow Properties of Active Pharmaceutical Ingredients, Kalyana Pingali, Kostas Saranteas, Fernando J. Muzzio, AIChE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Using Dem Models to Understand Segregation In Mixtures with Continuous Grain Size Distribution In Long Cylinders, Atul Dubey, Fernando J. Muzzio, Maria. S Tomassone, AIChE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

A Hydrodynamic Method for the Production of Nanoparticles, Eric Jayjock, Fernando J. Muzzio, AIChE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Study of Tablet Coating Thickness Uniformity Using Libs, Dem and Compartment Modeling, Atul Dubey, Patricia M. Portillo, Fernando J. Muzzio, AIChE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Predictive Modeling for Mixing and Feeding Processes Using Kriging Approach, Zhenya Jia, Eddie Davis, Fernando J. Muzzio, M.G. Ierapetritou, AICHE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Effects of Rotation Rate, Mixing Angle, and Cohesion In Two Continuous Powder Mixers – a Statistical Approach, Patricia M. Portillo, Aditya U. Vanarase, M.G. Ierapetritou, Fernando J. Muzzio, AICHE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Analysis of Operating Conditions of a Continuous Powder Mixer Using PEPT, Patricia M. Portillo, Andy Ingram, Jonathan P.K. Seville, M.G. Ierapetritou, Fernando J. Muzzio, AICHE Annual Meeting, Philadelphia, Pennsylvania, November 2008.

Some challenges of pharmaceutical manufacturing - The need for process understanding, invited talk, F.J. Muzzio, Meeting of the International Federation of Industrial Pharmacy, Basel Switzerland, August 29, 2008

Effects of shear rate and strain on powder blend and tablet properties. Llusá, M. and F.J. Muzzio, 18th International Congress of Chemical and Process Engineering (CHISA), 24 - 28 August 2008, Praha, Czech Republic.

Quantifying the effects of additives, lubricant, and processing conditions on the flow properties of pharmaceutical formulations using a novel instrument, Llusá, M., K. Pingali and F.J. Muzzio. 18th International Congress of Chemical and Process Engineering (CHISA), 24 - 28 August 2008, Praha, Czech Republic.

Chaotic Flow in Laminar Mixing in Stirred Vessels, Gabriel Ascanio and Fernando Muzzio, Presented at the International Symposium on Industrial Mixing Processes, Niagara Falls, Canada, August 20, 2008

Quantitative Design of Industrial Powder Mixing Systems Fernando Muzzio, Presented at the International Symposium on Industrial Mixing Processes, Niagara Falls, Canada, August 20, 2008

Predictive Methodology for Designing Inhaler Systems, Fernando Muzzio, invited talk Presented at the Design of Medical Devices Conference, Univ. of Minnesota, April 16, 2008

New Technologies Require New Skills Facilitating Global Change, Fernando Muzzio, invited talk Presented at the European Arden House, London, UK, April 2, 2008

Product and Process Design: Powder Technology Gaps, Fernando Muzzio, invited talk Presented at the European Arden House, London, UK, March 31, 2008

Optimization of Pharmaceutical Products and Processes, Fernando Muzzio, invited talk presented at the 43rd AAPS Arden Conference US, West Point, NY

Powder Mixing and Content Uniformity, Fernando Muzzio, invited talk presented at the 43rd AAPS Arden Conference US, West Point, NY

A Quality by Design approach to pharmaceutical blending, invited talk presented at the ECI conference on Particulate Processes in the Pharmaceutical Industry, Fernando J. Muzzio, Rio Grande, Puerto Rico, February 2008

Optimization of Pharmaceutical Manufacturing Processes Using Engineering Principles, Fernando J. Muzzio, invited talk presented at the AAPS Annual Meeting, San Diego, November 2007

Evaluation of Strain and Shear Effects in Pharmaceutical Blends Using near Infrared Spectroscopy, Wandylis Vargas, Manel Alcalà, Marcos Llusá, Fernando J. Muzzio, Rodolfo J. Romañach, AICHE Annual Meeting, Salt Lake City, November 2007.

Study of the Lubrication Effect on the Feedframe, Rafael Mendez-Roman, Alvaro Realpe, Carlos Velazquez-Figueroa, Fernando J. Muzzio, AICHE Annual Meeting, Salt Lake City, November 2007.

Experimental And Dem Study Of The Compaction Of Blends In A Shear Environment, Marcos Llusa, Fernando Muzzio, Bodhisattwa Chaudhuri, AICHE Annual Meeting, Salt Lake City, November 2007.

Relation Between Flow And Electrical Properties Of Pharmaceutical Blends, Kalyana Pingali, Fernando. J Muzzio, Troy Shinbrot, Maria. S Tomassone, AICHE Annual Meeting, Salt Lake City, November 2007.

Experimental Study And Computational Modeling Of Continuous Powder Mixing Processes, Patricia M. Portillo, Marianthi G. Ierapetritou, Fernando J. Muzzio, AICHE Annual Meeting, Salt Lake City, November 2007.

Study of the Feedframe Effect on Particle Size Distribution, Rafael Mendez-Roman, Fernando J. Muzzio, Carlos Velazquez, AICHE Annual Meeting, Salt Lake City, November 2007.

Shear-Thinning Mixing With Three-Coaxial Pitched-Blade Impellers, Justin P. Lacombe, Fernando J. Muzzio, Ben Glasser, Troy Shinbrot, AICHE Annual Meeting, Salt Lake City, November 2007.

Discrete Element Simulation Of The Mixing Process In A Pancoater, Atul Dubey, Bodhisattwa Chaudhuri, M. Silvina Tomassone, Fernando J. Muzzio, AICHE Annual Meeting, Salt Lake City, November 2007.

An Approach For The Parallelization Of The Discrete Element Code, Atul Dubey, M. Silvina Tomassone, Fernando J. Muzzio, AICHE Annual Meeting, Salt Lake City, November 2007.

A High Intensity Emulsification Method For The Production Of Nanoparticles, Eric Jayjock, M. Silvina Tomassone, Fernando J. Muzzio, AICHE Annual Meeting, Salt Lake City, November 2007.

Computational Modelling Of The Anderson Cascade Impactor, Eric Jayjock, Fernando J. Muzzio, AICHE Annual Meeting, Salt Lake City, November 2007.

The Effects Of Material And Processing Variables On The Properties Of Formulations, Marcos Llusa, Fernando Muzzio, Kalyana Pingali, AICHE Annual Meeting, Salt Lake City, November 2007.

NSF Engineering Research Center for Structured Organic Particulate Systems, F. J. Muzzio, invited talk presented at the AICHE Annual Meeting, Salt Lake City, November 2007.

Pharmaceutical Manufacturing Past, Present, and Future – Invited Keynote lecture, Annual Congress of the Argentine Society of Industrial Pharmacy and Biochemistry, Buenos Aires, Argentina, September 2007

Cohesion, Cracking, Dilation, and Flow -- Rheological Behavior of Cohesive Pharmaceutical Powders (Invited Speaker) Fernando Muzzio, American Physical Society March 2007 meeting, Denver, CO.

Quantification of Powder Cohesion Using an Experimental Approach D. Zhang, A. Mehrotra, A. M. Faqih, B. Chaudhuri, M. Llusa, M. S. Tomassone, and F. J. Muzzio, AICHE Annual Meeting, November, 2006.

Menagerie of Topology in 3d Steady Flow F. J. Muzzio and J. P. Lacombe AICHE Annual Meeting, November, 2006.

Impact of the Unstable/Neutral Angle on Rate and Extent of Chemical Reaction J. P. Lacombe, and F. J. Muzzio AICHE Annual Meeting, November, 2006.

NIPTE Technology Roadmap: Funding Successes & Next Steps G. V. Reklaitis and F. J. Muzzio AICHE Annual Meeting, November, 2006.

NIPTE Technology Roadmap: Process Development F. J. Muzzio AICHE Annual Meeting, November, 2006.

A Hydrodynamic Method for the Continuous Production of Nanoparticles E. Jayjock, M. S. Tomassone, F. J. Muzzio AICHE Annual Meeting, November, 2006.

A Quantitative Method for Reconstructing Blend Composition Distributions in the Presence of Agglomerates M. Llusa, F. J. Muzzio AICHE Annual Meeting, November, 2006.

Shear-Induced Compaction of Pharmaceutical Formulations M. Llusa, B. Chaudhuri, M. S. Tomassone, M. Faqih, A. Mehrotra, F. J. Muzzio AICHE Annual Meeting, November, 2006.

Characterization and Modeling of Continuous Convective Powder Mixing Processes P. M. Portillo, M. Ierapetritou, F. J. Muzzio AICHE Annual Meeting, November, 2006.

Quantification of Powder Cohesion Using an Experimental Approach D. Zhang, A. Mehrotra, A. M. Faqih, B. Chaudhuri, M. Llusa, M. S. Tomassone, F. J. Muzzio AICHE Annual Meeting, November, 2006.

Stress Distribution in the Avalanching Flow of Cohesive Granular materials in a Rotating Vessel, B. Chaudhuri, A. Mehrotra, M. S. Tomassone. AICHE Annual Meeting, November, 2006.

Experimentally Validated Computations of Heat Transfer in Granular flow in Rotary Calciners, B. Chaudhuri, F. J. Muzzio, M. S. Tomassone, AICHE Annual Meeting, November, 2006.

DEM Simulations of "Dry Cohesion" Effects in Powder Compaction, A. Mehrotra, B. Chaudhuri, F. J. Muzzio, M. S. Tomassone, AICHE Annual Meeting, San Francisco, November, 2006.

Correlating Density Measurements to Flow Behavior of Cohesive Granular Materials, A. Faqih, B. Chaudhuri, A. Mehrotra, F. J. Muzzio, M. S. Tomassone, AICHE Annual Meeting, November, 2006.

Shear induced Compaction of Pharmaceutical Formulations, M. Llusa, B. Chaudhuri, A. Mehrotra, M. S. Tomassone, F. J. Muzzio, AICHE Annual Meeting, San Francisco, November, 2006.

Education Roadmap in Pharmaceutical Engineering and Science, F. J. Muzzio, ISPE Annual Meeting, November 2006

Detection and characterization of agglomerates in powder blends, M. Llusa & F. J. Muzzio, AAPS Annual Meeting, November 2006

Pharmaceutical Manufacturing Past, Present, and Future – Invited Keynote lecture, Inter-American Congress on Chemical Engineering, Buenos Aires, Argentina, October 2006

Modeling Granular Mixing Processes Utilizing a Hybrid DEM-Compartment Modeling Approach P. M. Portillo, F. J. Muzzio, M. G. Ierapetritou AICHE Annual Meeting, November, 2005

The Interstate Highway System of Fluid Flow: a Flow Skeleton Method to Study Mixing in Realistic 3d Autonomous Flows J. P. Lacombe, F.J. Muzzio AICHE Annual Meeting, November, 2005

Tendrils and Sheets: Topology of Injections in Steady Chaotic 3d Flow J. P. Lacombe, F.J. Muzzio AICHE Annual Meeting, November, 2005

Modeling of Heat Transfer in Granular Flow in Rotating Vessels, B. Chaudhuri, F. J. Muzzio, M. S. Tomassone. AICHE Annual Meeting, November, 2005

Flow-Induced Dilation of Fine Powders in a Rotating Drum, A.Faqih, B Chaudhuri, F. J. Muzzio, M. S. Tomassone, AICHE Annual Meeting, November, 2005.

Novel Bioreactor Design for the Culture of Suspended Mammalian Cells. M. I. Sánchez Cervantes, J. Castillo Reyna, J. Lacombe, F.J. Muzzio, M. M. Alvarez, AICHe Annual Meeting, 2005.

Use of a Novel Shear Cell to Study the Influence of Shear Intensity and Total Shear on the Properties of Pharmaceutical Blends, Amit Mehrotra, Abdul M. Faqih, Marcos Llusa, Fernando J. Muzzio; AICHe Annual Meeting, 2005.

A Method for Predicting Hopper Flow Characteristics of Unconfined Cohesive Powders Abdul M. Faqih, Bodhisattwa Chaudhuri, Amit Mehrotra, M. Silvina Tomassone, Fernando J. Muzzio, AICHe Annual Meeting, 2005.

Effect of shear intensity and total shear on blend and tablet properties Amit Mehrotra, Marcos Llusa, Fernando J. Muzzio, poster AAPS Annual Meeting, November 2005

Control of Pharmaceutical Manufacturing Processes, Invited Talk, ISPE Summer Meeting, Orlando, Fl, June 2005

Effect of cohesion on granular mixing in the rotating drum: Simulations and Experiments”, Amit Mehrotra, Bodhisattwa Chaudhuri, M. Silvina Tomassone, Fernando J Muzzio AIChE Annual Meeting, 2004.

Development of Control Strategies for Blending Operations in Pharmaceutical Processes P.Portillo, M. Ierapetritou, F. J. Muzzio, Paper 414m, AIChE Annual Meeting, Austin, TX, November 2004.

Mixing Analysis in Laminar 3D Flows using pLIF, P. Arratia, F. J. Muzzio Paper 328c, AIChE Annual Meeting, Austin, TX, November 2004.

Topology of Three-Dimensional Flow in Stirred Tanks. J. Lacombe, F. J. Muzzio, Paper 214j, AIChE Annual Meeting, Austin, TX, November 2004.

Mixing Challenges in the USP Apparatus 2, F.J. Muzzio, J. Baxter, J. Kukura Paper 468e, AIChE Annual Meeting, Austin, TX, November 2004.

Hydrodynamic-Induced Variability in the USP Apparatus 2, F.J. Muzzio, J. Baxter, J. Kukura Paper 445b, AIChE Annual Meeting, Austin, TX, November 2004.

The PAT Initiative: the hour of the Pharmaceutical Engineer, F.J. Muzzio Paper 445a, AIChE Annual Meeting, Austin, TX, November 2004.

Effect of cohesion on granular mixing in the rotating drum: Simulations and Experiments. A. Mehrotra, F.J. Muzzio, M. S. Tomassone, B. Chaudhuri, Paper 278d, AIChE Annual Meeting, Austin, TX, November 2004.

Rheology of Avalanches, F.J. Muzzio, A.W Alexander B. Chaudhuri, A. M. Faqih, Paper 284f, AIChE Annual Meeting, Austin, TX, November 2004.

Experimental visualization of mixing pathologies in laminar stirred tank bioreactors. 5th International Symposium on Mixing in Industrial Processes. Sevilla España, 2004. M. M. Alvarez, M. Elías, P. Arratia, T. Shinbrot, and F. J. Muzzio.

Chaotic Mixing in 3D Flows, 56 th Annual Meeting of the Division of Fluid Dynamics, DFD-APS. The Gallery of Fluid Motion. 2003, P. E. Arratia, M. M. Alvarez, T. Shinbrot and F. J. Muzzio.

Chaotic Mixing in Viscous Fluids. 56 th Annual Meeting of the Division of Fluid Dynamics, DFD-APS. The Gallery of Fluid Motion. NOVEMBER 23-25, 2003, M. M. Alvarez, T. Shinbrot and F. J. Muzzio.

Mixing Pathologies in Laminar Bioreactors. M. Elías, P. Arratia, T. Shinbrot, L. Galán-Wong, F. J. Muzzio, and M. M. Alvarez-Hernández, AIChE Annual Meeting, San Francisco California Ca., November 2003.

Impeller Blade Effects in Stirred Tanks at Laminar Conditions, J. Kukura and F. J. Muzzio, Paper 364d, AIChE Annual Meeting, San Francisco, CA, November 2003

Mixing Improvements & Scale-Up of Viscoplastic Fluids in Stirred Tanks, J. Kukura, P. Arratia, and F. J. Muzzio, Paper 458d, AIChE Annual Meeting, San Francisco, CA, November 2003

Mixing Analysis of the USP Apparatus II, J. Baxter, J. Kukura, and F. J. Muzzio, Paper 366c, AIChE Annual Meeting, San Francisco, CA, November 2003

Pharmaceutical Engineering: A Synthesis of Engineering, Material Science, and Pharmacy for Scientifically-Based Products and Process Development, F. J. Muzzio and P. Armenante, Paper 344a, AIChE Annual Meeting, San Francisco, CA, November 2003

A Rational Response to the FDA Process Analytical Technologies initiative: Development of Integrated Design and Control Technology Platforms for Optimum Manufacturing of Pharmaceutical Products, F.J. Muzzio Paper 5d, AIChE Annual Meeting, San Francisco, CA, November 2003

Neutral Mixing Directions in Three-Dimensional Chaotic Flows, E. Szalai, J. Kukura, and F. J. Muzzio, Paper 364f, AIChE Annual Meeting, San Francisco, CA, November 2003

Measuring Powder Cohesion and Comparison to Mixing Data, A. Alexander, C. Davies, A. Faqih, and F. J. Muzzio, Paper 41c, AIChE Annual Meeting, San Francisco, CA, November 2003

Experiments and Simulations of Granular Materials in Bin-Blenders: Free-Flowing and Pharmaceutical Blends, P. Arratia and F. J. Muzzio, Paper 367a, AIChE Annual Meeting, San Francisco, CA, November 2003

Panel Discussion on Education in Particle Technology F. J. Muzzio, Paper 50a AIChE Annual Meeting, San Francisco, CA, November 2003

The Distribution of Length Scales in 2D Aperiodic Chaotic Flows M. Alvarez and F. J. Muzzio, Paper 173a, AIChE Annual Meeting, Indianapolis, IN, November 2002

The Dynamics of Enhanced Stretching in Three-dimensional Chaotic Flows P. Arratia, E. Szalai, J. Kukura, and F. J. Muzzio, Paper 94k, AIChE Annual Meeting, Indianapolis, IN, November 2002

Spontaneous Chaos: Viscoelastic Mixing Effects in a Stirred Tank P. Arratia, and F. J. Muzzio, Paper 93h, AIChE Annual Meeting, Indianapolis, IN, November 2002

Mixing Improvements for Laminar Flow CSTRs, P. Arratia and F. J. Muzzio, Paper 176c, AIChE Annual Meeting, Indianapolis, IN, November 2002

Quantification of Cohesive Powder Flow Properties Using a Novel Powder Rheometer, E. Shen, N. Duong, and F. J. Muzzio, Paper 139b, AIChE Annual Meeting, Indianapolis, IN, November 2002

NIR Analysis of Powder Mixing in a Ribbon Blender, C. Goodridge, E. Shen, N. Duong, and F. J. Muzzio, Paper 177f, AIChE Annual Meeting, Indianapolis, IN, November 2002

Predicting Mixing Microstructure in 3D Laminar Mixing Flows, E. Szalai and F. J. Muzzio, Paper 382f, AIChE Annual Meeting, Indianapolis, IN, November 2002

Rational Approach to Tablet Dissolution, F.J. Muzzio, PDA annual meeting, Washington, DC, December 2001

Phase Separation Instabilities in Slurries, Nhat-Hang Duong, Anette E. Hosoi, F.J. Muzzio and Troy Shinbrot, paper 185d, AIChE Annual Meeting, Reno, NV, November 2001

Eccentric Mixing Structure in Stirred Tanks, Troy Shinbrot, F.J. Muzzio and Justin P. Lacombe, paper 226d, AIChE Annual Meeting, Reno, NV, November 2001

Dynamics of Laminar Mixing in Continuous Reactors, Nhat-Hang Duong, Troy Shinbrot and F.J. Muzzio, paper 200d, AIChE Annual Meeting, Reno, NV, November 2001

NIR Analysis of Powder Mixing Quality in a Ribbon Blender, Christopher Goodridge, Nhat-Hang Duong, and F.J. Muzzio, paper 200g, AIChE Annual Meeting, Reno, NV, November 2001

Self-Similarity of Concentration Profiles in a Lamellar Model System, Joseph Kukura, Edit Ambrozy and F.J. Muzzio, paper 359d, AIChE Annual Meeting, Reno, NV, November 2001

A Variation on Granular Shear Studies, Paulo E. Arratia and F.J. Muzzio, paper 226h, AIChE Annual Meeting, Reno, NV, November 2001

Quantitative Characterization of Powder Mixing & Sampling Processes, F.J. Muzzio, Land O' Lakes Conference, June 2001

Laminar Mixing of Non-Newtonian Fluids in Batch Stirred Tanks, paper 1.7, F.J. Muzzio and P. Arratia, Mixing XVIII, North American Mixing Forum, Pocono Manor, PA, June 2001

Mixing of Cohesive Powders in Batch Tumbling Blenders, F.J. Muzzio, P. Arratia, N. H. Duong, and O. Sudah, paper 2.7, Mixing XVIII, North American Mixing Forum, Pocono Manor, PA, June 2001

Prediction of Striation Thickness Distribution and Intermaterial Area Density in Steady 3D Chaotic Flows, E. S. Ambrozy and F. J. Muzzio, paper 5.5, Mixing XVIII, North American Mixing Forum, Pocono Manor, PA, June 2001

The Dynamics of Laminar Mixing in CSTR's, F.J. Muzzio, P. Arratia, Mixing XVIII, North American Mixing Forum, Pocono Manor, PA, June 2001

The Mechanism for Mixing in 3D Laminar Systems, paper MS34, T. Shinbrot and F. J. Muzzio SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 2001.

Obtaining Strategies for Effective Powder Blending and Sampling: a Regulatory and Scientific Perspective, Institute for International Research: Blend Uniformity Validation, Coral Gables, FL, February 2001

Spontaneous Chaos in Viscoelastic Mixing, F.J. Muzzio, M.M. Alvarez, J.M. Zalc and T. Shinbrot, paper BH 6, APS 53rd Annual Meeting, Division of Fluid Dynamics, Washington, D.C., November 2000

Waves Deep in the Big Muddy: Pattern Formation in Slurry Flows, T. Shinbrot, Nhat-Hang Duong and F.J. Muzzio, paper AH 4, APS 53rd Annual Meeting, Division of Fluid Dynamics, Washington, D.C., November 2000

Predicting the Spatial Structure of Chemical Reaction in Laminar Flows, F.J. Muzzio, M.M. Alvarez, J.M. Zalc, E.S. Ambrozy and S. Cerbelli, paper 337f, AIChE Annual Meeting, Los Angeles, CA, November 2000

Spontaneous Chaos in Non-Newtonian Flows in Stirred Tanks, F.J. Muzzio, P.E. Arratia and M.M. Alvarez, paper 135f, AIChE Annual Meeting, Los Angeles, CA, November 2000

Three Dimensional Computation of Flow, Mixing, and Segregation in Tote-Blenders, O. Sudah and F.J. Muzzio, paper 30d, AIChE Annual Meeting, Los Angeles, CA, November 2000

New Approaches for Accurate Blend Homogeneity Testing, AAPS Annual Meeting and Exposition, Indianapolis, IN, November 2000

Powder Blending, PQRI Blend Uniformity Workshop, Arlington, VA, September 2000

New Devices for Physical Sampling, PQRI Blend Uniformity Workshop, Arlington, VA, September 2000

Computational Study of Mixing in a Kenics Static Mixer as a Function of Geometry, E. Ambrozy, J.M. Zalc and F.J. Muzzio, paper E4.6, CHISA 2000, Prague, Czech Republic, August 2000

A Detailed Computational and Experimental Study of Laminar Mixing Processes in a Three Rushton Turbine Stirred Tank, J.M. Zalc, M.M. Alvarez and F.J. Muzzio, paper E3.6, CHISA 2000, Prague, Czech Republic, August 2000

Prediction of Micromixing Intensity in Chaotic Flows, S. Cerbelli, M.M. Alvarez and F.J. Muzzio, paper E2.4, CHISA 2000, Prague, Czech Republic, August 2000

Mixing and Segregation of Powders, 21st IFPRI Annual General Meeting, Scheveningen, Den Haag, The Netherlands, July 2000

Powder Mixing and Sampling in Process Scale-Up, AAPS Regional Eastern Conference, Morris Plains, NJ, June 2000

Three Lessons in Tumbling Mixing, Pfizer, Morris Plains, NJ, June 2000

Spontaneous Granular Segregation Reversal and Symmetry Breaking in 3D Tumblers, A. Alexander, T. Shinbrot and F.J. Muzzio, paper jk8, APS, DFD Annual Meeting, New Orleans, LO, November 1999.

Reversible and Shape-induced Segregation in Vibrated Granular Systems, E. Van Doorn, T. Shinbrot, and F.J. Muzzio, paper jk9, APS, DFD Annual Meeting, New Orleans, LO, November 1999.

Creation and Evolution of Structure in Laminar Stirred Tanks, M. M. Alvarez, J. M. Zalc, P. Arratia, T. Shinbrot, and F.J. Muzzio, paper bc4, APS, DFD Annual Meeting, New Orleans, LO, November 1999.

Attractive Tori in Conservative Transient Flows T. Shinbrot, M. M. Alvarez, J. M. Zalc, and F.J. Muzzio, paper dc7, APS, DFD Annual Meeting, New Orleans, LO, November 1999.

Scaling Granular Flows in Tumbling Blenders, A.W. Alexander, F.J. Muzzio, T. Shinbrot, paper 136d, AIChE Annual Meeting, Dallas, TX, November 1999

The Mechanism of Laminar Mixing in Stirred Tanks, M.M. Alvarez, F.J. Muzzio, T. Shinbrot, and J.M. Zalc, paper 125j, AIChE Annual Meeting, Dallas, TX, November 1999

Quantitative Characterization of Mixing and Segregation Processes in Rotary Calciners, F.J. Muzzio, B. Shah, and O. Sudah, paper 134j, AIChE Annual Meeting, Dallas, TX, November 1999

Quantitative Characterization of Mixing in Tote(Bin)-Blenders, F.J. Muzzio and O. Sudah, paper 45i, AIChE Annual Meeting, Dallas, TX, November 1999

The Mechanisms of Laminar Mixing in Stirred Tanks, M.M. Alvarez, F.J. Muzzio, paper 166g, AIChE Annual Meeting, Dallas, TX, November 1999

Laminar Mixing in Eccentric Stirred Tank Systems, M.M. Alvarez, F.J. Muzzio, T. Shinbrot, and J.M. Zalc, paper 166h, AIChE Annual Meeting, Dallas, TX, November 1999

Validated CFD Tools for Laminar Mixing Simulations in Stirred Tank Reactors, M.M. Alvarez, F.J. Muzzio, and J.M. Zalc, paper 164h, AIChE Annual Meeting, Dallas, TX, November 1999

The Importance of Successful Powder Blending in the Pharmaceutical Process, 1999 EPTM Meeting, Morris Plains, NJ, October 1999.

The Mechanism of Mixing in Stirred Tank Reactors, F.J. Muzzio, Mixing 17, NAMF, Banff (Canada), August 1999

Simulation of Flow and Mixing in Stirred Tank Reactors, J.M. Zalc, M.M. Alvarez, and F.J. Muzzio, ASME Symp. Series, 2nd International Symposium on Computational Technology (CFD) For Fluid/Thermal/Chemical Systems and Industrial Applications, Boston MA August 1999

Reverse Buoyancy in Shaken Granular Beds, T. Shinbrot, F. J. Muzzio IUTAM Symp on segregation in granular flows, Cape May NJ June 1999

Granular Chaos: A Mechanism for Mixing of Cohesive Powders in Tumbling Blenders, F. J. Muzzio, IFPRI Annual Meeting, Bound Brook, NJ, June 1999

Mixing and Segregation Phenomena in Vibrated Granular Beds, F. J. Muzzio, IFPRI Annual Meeting, Bound Brook, NJ, June 1999

Spontaneous Chaotic Granular Mixing, T. Shinbrot, A. Alexander, and F.J. Muzzio, Fifth SIAM conference on applications of dynamical systems, paper CP11, Snowbird, Utah, May 1999

Chaotic Mixing of Cohesive Powders in Tumbling Blenders, F. J. Muzzio and T. Shinbrot, Hewitt Symposium, University of Connecticut, Storrs, CT, May 1999

Mechanisms of Mixing in Tumbling Blenders, F.J. Muzzio, Symposium on Particle Technology at NJIT- Newark, NJ, March 1999.

Chaotic Granular Mixing, T. Shinbrot, A. Alexander, and F.J. Muzzio, Symposium on Particle Technology at NJIT- Newark, NJ, March 1999.

Lagrangian Analysis of Chaotic Mixing in Three dimensional Industrially Relevant Laminar Flows, M.M. Alvarez, S. Cerbelli, J. Zalc and F.J. Muzzio, ICheaP 4 Conference, Florence, Italy, March 1999.

Quantification of Mixing in Laminar Flows, S. Cerbelli, F.J. Muzzio, ICheaP 4 Conference, Florence, Italy, March 1999.

Reverse Buoyancy in Shaken Granular Beds, T. Shinbrot and F.J. Muzzio, Paper AD 4, APS 51 Annual Meeting, Division of Fluid Dynamics, Philadelphia, PA, November 1998.

Numerically Accessible Tools for Quantifying Mixing, S. Cerbelli and F.J. Muzzio, Paper NC 5, APS 51 Annual Meeting, Division of Fluid Dynamics, Philadelphia, PA, November 1998.

Granular Plumes, T. Shinbrot, A. Alexander, and F.J. Muzzio, Paper BD 1, APS 51 Annual Meeting, Division of Fluid Dynamics, Philadelphia, PA, November 1998.

Mixing Microstructure Generated by Aperiodic 2D Flows, M.M. Alvarez and F.J. Muzzio, Paper NC 7, APS 51 Annual Meeting, Division of Fluid Dynamics, Philadelphia, PA, November 1998.

Laminar Mixing in Asymmetric Stirred Tank Systems, K. Laporta, M.M. Alvarez, and F.J. Muzzio, paper 181-6b, AIChE Annual Meeting, Miami Beach, FL, Nov. 1998

Size Induced Segregation in Double Cone Blenders, E. Spartalis, A. Alexander, T. Shinbrot, and F.J. Muzzio, paper 181-6c, AIChE Annual Meeting, Miami Beach, FL, Nov. 1998

Analysis of Size Segregation of Cohesionless Granular Materials in Double Cone Blenders, M. Moakher, T. Shinbrot, F.J. Muzzio, paper 33e, AIChE Annual Meeting, Miami Beach, FL, Nov. 1998

Hyperbolic Periodic Points: "Supermixing" Engines, M.M. Alvarez, S. Cerbelli, J. Zalc and F.J. Muzzio, paper 189c, AIChE Annual Meeting, Miami Beach, FL, Nov. 1998

Mixing and Segregation of Powders in V-Blenders, A. Alexander, T. Shinbrot, F.J. Muzzio, paper 262c, AIChE Annual Meeting, Miami Beach, FL, Nov. 1998

Granular Mixing in a Tote-Blender (Bin Blender), F.J. Muzzio, T. Shinbrot, O. Sudah, paper 263c, AIChE Annual Meeting, Miami Beach, FL, Nov. 1998

Particle Image Velocimetry (PIV) Measurements for Characterization of Suspension Flows, H.M. Buettner, O. Hassan, F.J. Muzzio, paper 264c, AIChE Annual Meeting, Miami Beach, FL, Nov. 1998

Effect of Resin Characteristics on Expanded Bed Adsorption of Proteins, P. Wright, B.J. Glasser, F.J. Muzzio, paper 264g, AIChE Annual Meeting, Miami Beach, FL, Nov. 1998

Optimization of Mixing and Cell Settling in the Roller Bottle Bioreactor, J. Aunins, J. Bramble, J. Searles, F.J. Muzzio, D. Unger, paper 275 a, AIChE Annual Meeting, Miami Beach, FL, Nov. 1998

Granular Chaos, T. Shinbrot, A. Alexander, and F.J. Muzzio, paper 37c, AIChE Annual Meeting, Miami Beach, FL, Nov. 1998

The Geometry of Mixing in Time-Periodic Chaotic Flows, paper P7.145, M. Giona, A. Adrover, F. J. Muzzio, S. Cerbelli, M. M. Alvarez, CHISA 1998, Prague, Czech Republic, August 1998.

The Evolution of Material Line Curvature in Deterministic Chaotic Flows, S. Cerbelli, J. M. Zalc, and F. J. Muzzio, paper P7.152, CHISA 1998, Prague, Czech Republic, August 1998

Quantitative Characterization of Powder Mixing and Segregation Processes in V-blenders and Double-Cone Blenders, F. J. Muzzio, paper G7.2, CHISA 1998, Prague, Czech Republic, August 1998

Invariant Properties of Short-Time Liapunov Exponents in 2D Incompressible Mixing Systems, A. Adrover, M. Giona, F. J. Muzzio, S. Cerbelli, M. M. Alvarez, paper C6.3, CHISA 1998, Prague, Czech Republic, August 1998

The Dynamics and Statistics of Length Scales Generated by Mixing Processes in Chaotic Flows, F. J. Muzzio, M. M. Alvarez, S. Cerbelli, A. Adrover, M. Giona, paper C3.3, CHISA 1998, Prague, Czech Republic, August 1998

Quantitative Characterization of Powder Mixing and Segregation Processes in Double-Cone Blenders, F. J. Muzzio, IFPRI Annual Meeting, Brighton, UK, July 1998

Quantitative Characterization of Powder Blending Systems, Land O' Lakes Conference, Milwaukee, Wisconsin, June 1998, F. J. Muzzio and Troy Shinbrot.

Quantitative Characterization of Powder Blending Systems, AAPS Pharm Tech Conference, Rio Grande, Puerto Rico, June 1998, F. J. Muzzio .

Optimization of Static Mixers, F. J. Muzzio and D. M. Hobbs, paper 104, 5th Chemical Congress of North America, ACS, Cancun (Mexico), Nov. 1997

Full-Field Velocity Vector Measurements in an Opposing Jet Mixer, Y. Zhao, R. S. Brodkey, and F. J. Muzzio, paper 101, 5th Chemical Congress of North America, ACS, Cancun (Mexico), Nov. 1997

Mixing and Segregation of Dry Powders in a Rocking Cylinder, F. J. Muzzio, C. Wightman, paper 126d, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

Numerical Simulation of Granular Flows with Applications to Mixing of Dry Powders, M. Moakher, F. J. Muzzio, paper 130b, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

Particle Velocity Characteristics of Suspension Flows from Particle Image Velocimetry (PIV) Measurements, O. S. Hasan, H. M. Buettner, F. J. Muzzio, paper 133n, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

Characterization of Flow and Mixing in an Impinging Jet Mixer at Low Reynolds Number, D. R. Unger, F. J. Muzzio, paper 149b, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

Numerical Calculation of Striation Thickness Distribution (STD) and Intermaterial Area Density (IAD) in 2-D Time-Periodic Chaotic Flows, M. M. Alvarez, F. J. Muzzio, A. Adrover, M. Giona, S. Cerbelli, paper 149c, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

The Effect of Injection Location, Flow, Ratio, and Geometry on Kenics Mixer Performance, F. J. Muzzio, D. M. Hobbs, paper 152a, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

Parallel-Competitive Reactions in Two-Dimensional Chaotic Flows, J. M. Zalc, F. J. Muzzio, paper 207b, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

Characterization of Flow and Mixing in an Impinging Jet Mixer at Low Reynolds Number, D. R. Unger, F. J. Muzzio, poster 145-1h, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

Numerical Characterization of Flow and Mixing in Static Mixers, E. S. Ambrozy, J. M. Zalc, and F. J. Muzzio, poster 145-6a, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

Characterization of Laminar Mixing Patterns in Stirred Tanks, P. Elkouss, D. Lamberto, and F. J. Muzzio, poster 145-6b, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

Evaluation of Mixing Efficiency Using Laser-Induced Image Analysis, J. Lowinger, M. Alvarez, and F. J. Muzzio, poster 145-6c, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

Using Laser-Induced Fluorescence to Study Mixing in Laminar Flows, D. Markley, D. Unger, and F. J. Muzzio, poster 145-6d, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

Size-Segregation in Laminar Systems due to Vibration, P. Welch, D. Brone, and F. J. Muzzio, poster 145-15p, AIChE Annual Meeting, Los Angeles, CA, Nov. 1997

The Distribution of Length Scales Generated by Mixing Processes in Time-Periodic Chaotic Flows, F. Muzzio, M. Alvarez, S. Cerbelli, paper Be.05, APS-DFD Annual Meeting, San Francisco, CA, Nov. 1997

Asymptotic Directionality: The Fundamental Property Controlling Topology and Dynamics in Chaotic Mixing Processes, M. Giona, A. Adrover, F. J. Muzzio, paper Be.06, APS-DFD Annual Meeting, San Francisco, CA, Nov. 1997

Jet Mixing, Verification of CFD with Full-field Velocity Vector Measurements Y. Zhao, R. Brodkey, D. Unger, F. J. Muzzio, paper Ib.10, APS-DFD Annual Meeting, San Francisco, CA, Nov. 1997

Nonuniform Stationary Measure Properties of a Class of Area-Preserving Mixing Systems, S. Cerbelli, A. Adrover, M. Giona, F. J. Muzzio., paper Be.07, APS-DFD Annual Meeting, San Francisco, CA, Nov. 1997

Powder Blending: Sampling and Statistics (Invited lecture), AAPS Annual meeting, Boston, MA, Nov 1997

Self-Similar Spatio-temporal Structure of Material Filaments in Chaotic Flows, International Conference on Fractals in Engineering, Arcachon, France, June 1997, F.J. Muzzio, M.M. Alvarez, S. Cerbelli, A. Adrover.

Quantitative Characterization of Powder Blending Systems, AAPS Arden House Meeting, Harriman, NY, January 1997, F. J. Muzzio .

Enhanced Mixing in Static Mixers Using Dynamical Systems Techniques, AIChE Annual meeting, Chicago, IL, November 1996, paper 39g, D.M. Hobbs and F. J. Muzzio.

Sampling Practices and Mixing Studies in Powder Blending, AIChE Annual meeting, Chicago, IL, November 1996, paper 166d, C. Wightman, D. Brone, and F. J. Muzzio.

Using Chaos to Enhance Mixing in Industrial Systems, International Conference on Chaos and Fractals in Chemical Engineering, Rome, Italy, August 1996, F. J. Muzzio .

Self-similar Phenomena in Chaotic Mixing Processes, International Conference on Chaos and Fractals in Chemical Engineering, Rome, Italy, August 1996, F. J. Muzzio .

Quantitative Characterization of Powder Blending Systems, RETEC Meeting, St Louis, MO, October 1996, F. J. Muzzio .

Numerical Analysis of Motion and Deposition of Particles in Cascade Impactors, AIChE Annual meeting, Miami Beach, FL, November 1995, paper 221g, P.D. Swanson, F.J. Muzzio, A. Annapragada, and A. Adjei.

Quantification of Blending Processes in Twin-Shell Blenders, AIChE Annual meeting, Miami Beach, FL, November 1995, paper 132d, D. Brone, C. Wightman, K. Connor, A. Alexander, and F. J. Muzzio.

Quantitative Characterization of Powder Blending Processes, AIChE Annual meeting, Miami Beach, FL, November 1995, paper 131f, F. J. Muzzio and C. Wightman.

Characterization of Segregated Regions in Stirred Tank Systems, AIChE Annual meeting, Miami Beach, FL, November 1995, paper 124e, D. Lamberto, P. Wright, and F. J. Muzzio.

Quantitative Characterization of Powder Blending Processes, International Fine Powder Research Institute Annual meeting, Champaign, IL, June 1995, F.J. Muzzio .

Diffusion and Reaction in Heterogeneous Biological Materials, AAPS Eastern Chapter Annual meeting, New Brunswick, NJ, June 1995, M.R. Riley, F.J. Muzzio, H.M. Buettner, and S.C. Reyes.

Quantitative Characterization of Powder Blending Processes, AAPS Eastern Chapter Annual meeting, New Brunswick, NJ, June 1995, C. Wightman, F.J. Muzzio, and D.I. Brone.

Using Time-Dependent RPM to Enhance Mixing in Stirred Tanks, North American Mixing Forum XV meeting, Banff, Alberta (Canada), June 1995, F.J. Muzzio.

The Curvature Field in Time-Periodic Chaotic Flows, APS-DFD Annual meeting, Atlanta, GA, November 1994, M. Liu and F.J. Muzzio.

Using Time-Dependent RPM to Enhance Mixing in Stirred Tanks, APS-DFD Annual meeting, Atlanta, GA, November 1994, D. Lamberto, F.J. Muzzio, and P.D. Swanson.

Mixing in Aperiodic Chaotic Flows APS-DFD Annual meeting, Atlanta, GA, November 1994, F.J. Muzzio, M. Liu, D. Lamberto, and P.D. Swanson.

Rate Controlling Processes of Reaction and Diffusion in Biological Systems, AIChE Annual meeting, San Francisco, CA, November 1994, paper 61f, M.R. Riley, F.J. Muzzio, H.M. Buettner, and S.C. Reyes.

Diffusion and Reaction in Heterogeneous Biological Materials, AIChE Annual meeting, San Francisco, CA, November 1994, paper 110f, M.R. Riley, F.J. Muzzio, H.M. Buettner, and S.C. Reyes.

Mixing in Aperiodic Chaotic Flows AIChE Annual meeting, San Francisco, CA, November 1994, paper 87g, F.J. Muzzio, M. Liu, D. Lamberto, and P.D. Swanson.

Sintering Kinetics of Non-oxide Ceramics, AIChE Annual meeting, San Francisco, CA, November 1994, paper 202x, D. Lamberto, F. J. Muzzio, R. Riman, and D. Niesz.

Chemical Reactions in Chaotic Flows, AIChE Annual meeting, San Francisco, CA, November 1994, paper 236c, F.J. Muzzio, M. Liu, and R. Cruz.

Solids Mixing Experiments in a Rotary Drum Employing Unsteady Flows, AIChE Annual meeting, San Francisco, CA, November 1994, paper 161f, C. Wightman, F.J. Muzzio, D.I. Brone, and R. Riman.

An Immobilization and Microtoming Technique for Characterizing Particulate Mixing Processes, AIChE Annual meeting, San Francisco, CA, November 1994, paper 164d, C. Wightman, F.J. Muzzio, D.I. Brone, and R. Riman.

Using Time-Dependent RPM to Enhance Mixing in Stirred Tanks, ISCRE 14, Baltimore, MD, June 1994, D. Lamberto, F.J. Muzzio, and P.D. Swanson.

Diffusion and Reaction of Oxygen in Biological Systems, Biomed. Eng. Soc., Tempe, AZ, June 1994, M.R. Riley, H.M. Buettner, F.J. Muzzio, and S.C. Reyes.

Self-similar Phenomena in Chaotic Mixing, AIChE annual meeting, paper 139f, St. Louis, MO (1993), F.J. Muzzio and M. Liu.

Fractal Structures Formed by Discrete Particles in Time-Periodic Chaotic Flows, AIChE annual meeting, paper 58k, St. Louis, MO, November 1993, M. Liu, F.J. Muzzio, and R.L. Peskin.

Monte Carlo Calculation of Effective Diffusivities in Multiphase Conductive Media, AIChE annual meeting, paper 76f, St. Louis, MO, November 1993, F.J. Muzzio, M.R. Riley, S.C. Reyes, and H.M. Buettner.

Analysis of Diffusion, Reaction, and Cell Proliferation in Immobilized Cell Systems, AIChE annual meeting, paper 104h, St. Louis, MO, November 1993, M.R. Riley, D. Rintzler, F.J. Muzzio, H.M. Buettner, and S.C. Reyes.

Mixing of Discrete Particles in Chaotic Flows, APS annual meeting, DFD, paper JI1, Albuquerque, NM, November 1993, F.J. Muzzio, M. Liu, and R.L. Peskin.

Quantification of Mixing in Aperiodic Chaotic Flows, APS annual meeting, DFD, paper AG8, Albuquerque, NM, November 1993, M. Liu, F.J. Muzzio, and R.L. Peskin.

Flow Induced Aggregation, AIChE annual meeting, paper 79i, Miami Beach, FL, November 1992, F.J. Muzzio and D. Yasko.

Numerical Investigation of the Joint Scalar, Gradient, Lamella Thickness PDF in Random Lamellar Structures, AIChE annual meeting, paper 82g, Miami Beach, FL, November 1992, F.J. Muzzio, T. Pirog, and R.O. Fox.

Computational and Experimental Techniques for the Analysis of Stationary Phase Bioreactors, AIChE annual meeting, paper 151e, Miami Beach, FL, November 1992, M.R. Riley, M. Lovallo, F.J. Muzzio, and H.M. Buettner.

Statistical Study of the Stretching Field in a 2-D Periodic Cavity Flow, APS annual meeting, DFD, paper CH8, Tallahassee, FL, November 1992, F.J. Muzzio, M. Liu, and R.L. Peskin.

Exploiting Chaos: Transport Enhancement and Structuring in Fluid Flows, AIChE annual meeting, paper 142e, Los Angeles, CA, November 1991, S. Jana, F.J. Muzzio, P.D. Swanson, and J.M. Ottino.

Scaling and Multifractal Techniques for the Analysis of Chaotic Mixing, APS annual meeting, DFD, paper IH1, Scottsdale, AZ, November 1991, F.J. Muzzio, C. Meneveau, P.D. Swanson, and J.M. Ottino.

Analysis of Problems Leading to Spatial Disorder Based on Scaling and Multifractal Techniques, AIChE annual meeting, paper 173b, Chicago, IL, November 1990, J.M. Ottino, F.J. Muzzio, and P.D. Swanson.

Aggregation and Structure Formation in Chaotic Flows, APS annual meeting, DFD, paper CD3, Ithaca, NY, November 1990, T.J. Danielson, F.J. Muzzio, and J.M. Ottino.

Self-similarity in Mixing and Breakup in Chaotic Flows, APS annual meeting, DFD, paper CD5, Ithaca, NY, November 1990, F.J. Muzzio, M. Tjahjadi, P.D. Swanson, and J.M. Ottino.

Scaling in Chaotic Mixing, MRS fall meeting, Boston, MA, March 1990, J.M. Ottino, F.J. Muzzio, P.D. Swanson, and M. Tjahjadi.

Some Problems Arising from Mixing of Fluids Leading to the Application of Fractal Concepts, AIChE annual meeting, San Francisco, CA, November 1989, F.J. Muzzio, J.G. Franjione, and J.M. Ottino.

Coagulation in Chaotic Flows, AIChE annual meeting, Washington, DC, November 1988, F.J. Muzzio and J.M. Ottino.

Research Support

Federal

- 10/15-9/18 Food and Drug Administration (FJM PI), Real Time Release in Continuous Solid Dose Manufacturing: Systematic Characterization of Material Properties, and Optimal Design of Sensing and Control Methods \$4,000,000.
- 10/15-9/18 National Science Foundation AIR Commercializing Pharmaceutical Process Modeling for Continuous Manufacturing (B. Glasser PI, FJM Co-PI) (\$800,000+ 1:1 match from J&J).
- 10/14-9/17 Food and Drug Administration (M. Ierapetritou, PI, FJM Co-PI) Development of Process Simulation and Modeling Tools for Integrated Pharmaceutical Manufacturing Processes, \$500,000
- 7/14-6/17 National Science Foundation (A. Cuitiño PI, FJM Co-PI) SAVI grant to establish an International Institute for Advance Pharmaceutical Manufacturing (\$450,000)
- 7/14-7/15 Food and Drug Administration - Training modules for Continuous Manufacturing (Via NIPTE) (Rex Reklaitis PI) (\$120,000)
- 7/12-6/16 National Science Foundation (FJM PI, A. Cuitiño Co-PI) Engineering Research Center on Structured Organic Particulate Systems (\$12,000,000) (renewal of funding)
- 6/12-5/14 ARDEC (F. Muzzio PI) Methods for testing material used in various types of powder-based products of interest to the U.S. Army. (\$1,200,000)
- 7/12-6/14 Food and Drug Administration (FJM PI, J. Drennen Co-PI) Development of PAT platform technologies for drug manufacturing. \$60,000
- 5/12 – 4/14 National Science Foundation AIR Industry-Academia Research Partnership for Developing and Implementing Non-Destructive Characterization and Assessment of Pharmaceutical Oral Dosages in Continuous Manufacturing (A. Cuitiño PI, FJM Co-PI) (\$800,000+ 1:1 match from J&J)
- 1/10-12/12 National Science Foundation (M Ierapetritou PI, FJM co-PI, Commercialization of Continuous Manufacturing Technology (\$1,850,000)
- 7/09-6/14 National Science Foundation (FJM PI, A. Cuitiño Co-PI) Engineering Research Center on Structured Organic Particulate Systems (\$15,750,000) (renewal of funding)
- 12/08-12/10 FDA, Quality by Design, \$1,200,000, (Gintaras Reklaitis PI, Fernando Muzzio Co-PI, with six others).
- 7/06-6/11 National Science Foundation (FJM PI, A. Cuitiño Co-PI) Engineering Research Center on Structured Organic Particulate Systems (\$12,000,000) (including supplements for increased research (\$250,000), REU (\$80,000), RET (\$85,000), SBIR II (\$100,000)
- 7/05-6/10 National Science Foundation / National Institutes of Health (FJM PI, Maria Tomassone Co-PI) IGERT: Nanopharmaceutical Engineering (\$3, 219,046)
- 1/06-12/06 US Army (FJM Co-PI, Maria Tomassone PI) Flow Properties of Energetic Powders (\$99,000)
- 6/04-5/06 FDA (FJM PI) Analysis of Non-Gaussian Behavior in Blend Composition Distributions (\$50,000)
- 9/03-8/05 National Science Foundation, (FJM Co-PI, Maria Tomassone PI) Continuous Flow Induced Phase Inversion (\$100,000)
- 6/03-5/04 National Science Foundation, (FJM PI) I-UCRC Proposal to Join CPPR (\$10,000)
- 9/96-8/98 National Science Foundation (FJM PI), Renovation of Unusable Laboratory into a Modern Powder Technology Facility (\$500,000 from NSF and \$625,000 in matching funds from NJ State sources).

- 8/95-7/00 National Science Foundation (FJM Co-PI), *Pharmaceutical Engineering Graduate Research Traineeship* (\$562,000).
- 1/95-12/95 National Science Foundation - Hazardous Substances Management Research Center (FJM Co-PI), *Systematic Determination of Mixing Effects on Leaching Behavior of Solidified/Stabilized Contaminants*, \$47,000.
- 8/94-7/97 National Science Foundation (FJM PI), *Using Mixing to Minimize Waste in Reactive Systems* (\$240,000).
- 3/94-2/94 DOE/Pacific Northwest Laboratories (FJM Sole PI), *Preventing Pollution in Stirred Vessels* (\$20,000).
- 3/93-9/94 National Science Foundation (FJM PI), *Chaotic Mixing of Powders and Slurries* (\$50,000).
- 8/93-7/94 DOD/Geo-Centers (FJM PI), *Shock Wave Sensitivity of Propellants* (\$92,000).

State on NJ

- 1/07-12/07 New Jersey Commission on Science and Technology (FJM PI) Organic Nanotechnology Laboratory (\$100,000)
- 3/97-2/02 New Jersey Commission on Science and Technology (FJM PI and center director), *Particle Processing Research Center*, (\$1,500,000)
- 9/95-8/96 New Jersey Commission on Science and Technology - Technology Transfer Merit Program (FJM Sole PI), *Development of Software for the Analysis of Industrial Mixing Processes* (\$32,000)
- 9/94-8/95 New Jersey Commission on Science and Technology - Innovation Partnership Program (FJM PI - Competitive state-wide), *Development of Effective Powder Blending Technology* (\$36,845).
- 7/93-6/94 New Jersey Commission on Science and Technology - Technology Transfer Merit Program (FJM Sole PI - Competitive state-wide), *Developing User-friendly Software for Pollution Prevention in Reactive Systems* (\$20,000).

Industrial and Private Foundation

- 12/14-12/18 Rutgers-J&J strategic Partnership in Advanced Pharmaceutical Manufacturing (F.J. Muzzio PI) \$3,250,000
- 9/14-8/15 Rutgers Catalyst Manufacturing Consortium (FJM PI) Characterization of powder flow properties of catalyst support materials (renewal - \$40,000)
- 9/14-8/15 Rutgers Catalyst Manufacturing Consortium (with Alberto Cuitino) Design and Scale Up of Rotary Calciners (renewal - \$40,000)
- 7/14-6/18 J&J, Development of Predictive Models for Continuous Wet Granulation, (with M. Ierapetritou, R. Ramachandran, T. deBeer, and I. Nopens) \$2,000,000
- 7/14-6/15 Modeling of the INSPIRE line – J&J with M. Ierapetritou, R. Ramachandran, \$130,000
- 7/14 – 6/15 Industrial memberships for ERC - \$675,000 (10 sponsors) – collected so far
- 4/14 – 3/16 J&J, Design of a continuous manufacturing facility for Cana-Met, \$625,000
- 9/13-8/14 Rutgers Catalyst Manufacturing Consortium (FJM PI) Characterization of powder flow properties of catalyst support materials (renewal - \$40,000)
- 9/13-8/14 Rutgers Catalyst Manufacturing Consortium (with Alberto Cuitino) Design and Scale Up of Rotary Calciners (renewal - \$40,000)
- 7/13 – 6/14 Industrial memberships for ERC - \$430,000 (6 sponsors)
- 9/12-8/13 Rutgers Catalyst Manufacturing Consortium (FJM PI) Characterization of powder flow properties of catalyst support materials (renewal - \$40,000)

9/12-8/13 Rutgers Catalyst Manufacturing Consortium (with Alberto Cuitino) Design and Scale Up of Rotary Calciners (\$40,000)

7/12 – 6/13 Industrial memberships for ERC - \$825,000 (11 sponsors)

5/12 – 4/14 Industrial memberships for ERC - \$566,667 (8 sponsors)

9/11-8/12 Rutgers Catalyst Manufacturing Consortium (FJM PI) Characterization of powder flow properties of catalyst support materials (renewal - \$40,000)

4/11-12/13 J&J, Design of a continuous manufacturing facility for Prezista, \$600,000

9/10-8/11 Rutgers Catalyst Manufacturing Consortium (FJM PI) Characterization of powder flow properties of catalyst support materials (renewal - \$40,000)

7/10 – 6/11 Industrial memberships for ERC - \$840,000 (11 sponsors)

1/10-12/11 Haldor Topsoe, Optimization of ceramic tablet manufacturing, \$495,000

9/09-8/10 Rutgers Catalyst Manufacturing Consortium (FJM PI) Characterization of powder flow properties of catalyst support materials (\$40,000)

7/09 – 6/10 Industrial memberships for ERC - \$910,000 (11 sponsors)

6/09-5/10 Capsugel, Optimization and control of microdispensing of liquids and suspensions into hard capsules, \$250,000

1/09-12/09 Haldor Topsoe, Characterization of the performance of a gravimetric feeder for cohesive powders, \$70,000

1/09-12/09 Haldor Topsoe, Development and transfer of a GDR system, \$40,000

7/08 – 6/09 Industrial memberships for ERC - \$830,000 (10 sponsors)

06/08-06/09 Capsugel, Effect of powder flow properties on fill weight uniformity of pharmaceutical capsules, \$110,000

1/08-12/09 Pfizer, Effect of powder flow properties on performance of pharmaceutical tablets, (\$200,120)

1/08-12/08 Sepracor, Using LIBS to characterize tablet coating uniformity (\$67,000)

7/07 – 6/08 Industrial memberships for ERC - \$760,000 (10 sponsors)

7/07-6/08 Sepracor, Numerical simulation of coating pans (\$50,000)

7/06 – 6/07 Industrial memberships for ERC - \$1,700,000 (14 sponsors)

6/06 – 5/07 Asahi-Kasey (FJM PI) Comparative characterization of flow and mixing of MCC excipients (\$45,000)

6/06-12/08 Sepracor (FJM PI) Numerical analysis of particle deposition in cascade impactors (\$220,000)

3/06-8/07 GSK (FJM PI, M.S.Tomassone co-PI) Scale-up criteria of cohesive powder mixing processes (\$60,000)

1/06-12/06 BMS, Numerical simulation of coating pans (\$40,000)

1/06-6/07 Sepracor (FJM PI) Electrical properties of pharmaceutical powders (\$50,000)

1/06-12/06 Pfizer (FJM PI, Troy Shinbrot Co-PI, Maria Tomassone Co-PI) Electrostatic and Electrodynamic Properties of Pharmaceutical Powder (\$97,000)

1/06-9/06 Glaxo-SmithKline (FJM PI, Maria Tomassone Co-PI) Scale-up of blending Processes for Cohesive Powders (\$60,000)

9/05-9/06 Rutgers Catalyst Manufacturing Consortium (FJM PI) Mixing of Catalytic Materials (\$36,000)

8/05-8/06 GlattAir Techniques (FJM PI) Characterization of mixing rates in a biaxial mixer (\$60,000)

01/05-12/07 Heat Transfer in Calciner and Impregnator Systems (FJM PI) Rutgers Catalyst Manufacturing Consortium (\$96,000)

01/05-12/06 Pfizer, Merck, Apotex, Niro, (FJM PI) *Continuous Manufacturing of Pharmaceutical Products* (\$320,000)

9/03-9/08 Rutgers Catalyst Manufacturing Consortium (FJM PI, Maria Tomassone Co-PI) Rotary Calciners (\$180,000)

12/03-12/04 Pfizer (FJM PI), *Development of Tools for Powder Flow Characterization* (\$107,000)

12/02-12/04 Merck (FJM PI), *Understanding Lubrication* (\$112,000)

12/02-12/04 J&J (FJM PI), *Hydrodynamic Effects in USP II Dissolution Apparatus* (\$90,000)

12/02-12/04 Wyeth (FJM PI), *Development of Tools for Quantitative Characterization of Hydrodynamic Effects in the USP II dissolution Apparatus* (\$65,000)

12/02-12/03 Schering-Plough (FJM PI), *Quantitative Analysis of Flow Effects in the USP II dissolution Apparatus* (\$107,000)

12/03-12/04 J&J (FJM PI), *Scale-up analysis of Segregation Effects* (\$97,000)

12/03-06/04 J&J (FJM PI), *Flow Properties of Two Granulations* (\$50,000)

03/03-03/04 CAMP (FJM PI), *Development of Controlled Shear Testing Apparatus* (\$25,000)

1/02-1/03 Pfizer (FJM sole PI), *Methods for Design and Scale-up of Direct-compression Formulations* (\$77,000)

1/02-1/03 Pfizer (FJM sole PI), *Development of Tools for Powder Flow Characterization* (\$87,000)

1/00-1/01 Pfizer (FJM sole PI), *Mixing in Tote Blenders* (\$72,000)

6/01 – 6/02 Schering-Plough (FJM sole PI), *Development of high-shear operations in tote blenders* (\$70,000)

6/01 – 6/02 Merck, Kraft, Eirich (FJM sole PI), *Mixing in ribbon blenders* (\$60,000 in cash, \$60,000 in equipment)

6/01 – 6/02 J&J (FJM sole PI), *Development of direct-compression operations in tote blenders* (\$82,000)

7/00-6/01 Dow Chemical Company, *Mixing of High/low Viscosity Fluids* (\$50,000)

3/00-2/01 McNeil Consumer Products, *Development of Accurate Sampling Methods* (\$60,000)

3/00-2/01 Dow Chemical Company, *Mixing Microstructure in Reactive Flows* (\$35,000)

6/99-5/00 Bristol Myers Squibb (FJM sole PI), *CFD Tools for Mixing Analysis* (\$50,000)

5/99-4/00 Merck (FJM sole PI), *Mixing in Tote Blenders* (\$50,000)

3/99-12/99 Dantec (FJM sole PI), *Development of LIF Techniques for Mixing Analysis* (\$30,000)

3/99 –2/00 Fujitsu (FJM sole PI), *CFD Tools for Mixing Analysis* (\$80,000)

3/99-2/00 National Starch (Alberto Cuitiño PI, FJM Co-PI), *Mixing and Compression Characteristics of Starch Materials* (\$65,000)

3/99-2/02 Warner-Lambert (FJM sole PI), *Mixing in Tote Blenders* (\$44,000)

7/98-6/01 Dupont (FJM sole PI), *Dupont Education Award* (\$45,000)

5/98-4/02 Colgate (FJM sole PI), *Fellowship for PhD Research in Mixing* (\$100,000)

3/98 – 2/01 IFPRI (FJM sole PI), *Mixing and Segregation Mechanisms in Tumbling Blenders* (\$108,000)

3/98-2/00 Schering (FJM sole PI), *Fellowship for PhD Research in Pharmaceutical Engineering* (\$20,000)

12/97-12/02 Tor Pharm (FJM sole PI), *Mixing in Bin Blenders* (\$210,000)

12/97-12/99 GEI Gallay, *Mixing in Bin Blenders* (\$50,000 in equipment)

9/97-9/98 Mobil (FJM sole PI), *Mixing in Rotary Calciners* (\$30,000 in cash and \$50,000 in equipment)

8/97-2/03 Pfizer (FJM sole PI), *Shape-driven Segregation of Powders* (\$395,000)

12/95-12/97 Abbot Laboratories (FJM Sole PI), *Design of Agitation Systems for the Manufacture of Inhaled Dose Formulations* (\$160,000).

- 9/95-8/01 Merck, Bristol-Myers Squibb, National Starch, Abbott, Ganes and Procter&Gamble (consortium) (FJM PI), *Pharmaceutical Engineering Research Program* (\$1,200,000)
- 7/95-6/98 Dupont Professor Award (\$75,000)
- 3/95-2/96 Hoechst-Celanese Young Professor Award (\$20,000)
- 1/95-12/95 National Starch (FJM Sole PI), *Enhancing Mixing in Stirred Vessels* (\$20,000).
- 9/94-8/96 Rutgers Center for Ceramic Research (FJM PI), *Accurate Sampling Techniques for Powder Mixtures* (\$120,000).
- 7/94-6/95 ACS Petroleum Research Fund (FJM Sole PI), *Chemical Reactions in Chaotic Flows*, (\$20,000).
- 5/94-4/97 Abbot Laboratories (FJM Sole PI), *Deposition of Particles in the Human Lung* (\$200,000).
- 3/94-2/96 Hoechst-Celanese Corporation (FJM Sole PI), *Enhancing Mixing in Stirred Tank Reactors* (\$40,000).
- 1/94-12/99 Merck and Co. (FJM Sole PI), *Infection Processes in Bioreactors* (\$141,000).
- 1/94-12/97 Merck and Co. (FJM Sole PI) *Powder Blending Processes*, Merck and Co. (\$250,580).
- 7/93-6/95 Rutgers CAIP Center (FJM Sole PI), *Reactive Mixing in Chaotic Flows* (\$215,000).
- 7/93-6/94 Rutgers Center for Ceramic Research (FJM Co-PI), *Modeling Ceramic Powder Mixing Homogeneity* (\$40,000).
- 3/93-2/96 3M Foundation, *Untenured Faculty Award* (\$55,000).
- 9/92-8/96 Merck Foundation, *Fellowship for Young Faculty Development* (\$120,000).
- 9/92-8/94 Exxon Education Foundation Excellence Award (\$20,000).
- 7/92-6/94 Rutgers Center for Ceramic Research, (FJM PI), *Modeling Dynamics of Sintering of Non-Oxide Ceramics* (\$80,000).

Current Research Group

Directly supervised Staff and Professional Personnel

Dr. Douglass Hausner, Associate Director for Industrial Relations, ERC-SOPS

Post-doctoral Fellows and Research Faculty

Dr. Ravendra Singh, Assistant Research Professor (Since 7/2013)

Dr. Gerardo Callegari, Assistant Research Professor (Since 7/2014)

Dr. James Scicolone, Assistant Research Professor (Since 7/2013)

Dr. Andres Roman Ospino (Since 7/2018)

Dr. Sonia Razavi (Since 7/2018)

Doctoral Students

Golshid Keyvan (3rd year student)

Thamer Omer (3rd year student)

Zhanjie Liu (2nd year student)

Tianyi Li (2nd year student)

Chen Hao (2nd year student)

Wei Meng (2nd year student)

Masters Student (Partial)

Chandrakant Bhandhi since 6/2014

Peter Balogh since 9/2014

Sathish Kumar since 6/2014

Pathak Chinmay	since 9/2014
Charles Sam Cherian	since 1/2015
Shishir Vadodaria	since 1/2015

Previously Trained Scientists

Postdoctoral trainees

1. Dr. Savitha Panikar (8/2015 – 8/2018) Now at Hovione
2. Dr. Sara Moghtadernejad (4/2016-5/2018) Now at Univ. of California
3. Dr. Sarang Oka (1/2017 – 5/2017 - Currently at Hovione)
4. Dr. Pallavi Pawar (8/2016 – 3/2017 - Currently at GSK)
5. Dr. Zhonghui Huang (12/2015 – 5/2016) – currently with Patheon
6. Dr. Sejal Shah (6/2015-12/2016 – currently an independent consultant)
7. Dr. William Engisch (10/ 2014 – 6/2015) – Currently with Amgen
8. Dr. Jun Zhang (11/2014 – 9/2015) – currently with GSK
9. Dr. Xue Liu (July 2012-February 2015) – currently with BASF
10. Dr. Kellie Anderson (November 2012 – June 2014)
11. Dr. Heather Emady (June 2013-December 2014) currently an Assistant Professor at University of Arizona

12. Dr. Matthew Metzger (July 2012 – December 2012) Currently at Merck
13. Dr. Yevgeny Lifchitz (July 2011 – September 2012) Currently at Ivoclar Vivadent AG
14. Dr. Eric Jayjock (2011-2013), currently with Patheon
15. Dr. Atul Dubey (September 2007 – September 2012) Currently at Tridiagonal Solutions Pvt Ltd

16. Dr Athanas Koynov (September 2007 – September 2011), currently at Merck
17. Dr. Rafael Mendez (September 2009 – September 2011) (currently an Assistant Professor at Univ. of Puerto Rico)
18. Dr. Nicolas Heigl, 2011-2012, currently a psot doc at RCPE (Graz, Austria)
19. Dr. Kaliana Pingaly, currently an assistant Professor at Western Michigan University

20. Dr. Marcos Llusa (June 2004-December 2010), currently at RCPE, Graz, Austria
21. Dr Yurik Gulak (June 2008-June 2009)
22. Dr Patricia Portillo (June 2008-June 2009), currently at L'Oreal
23. Dr. Bodisatwa Chaudhuri July 2003-December 2006, tenured Associate Professor at University of Connecticut, School of Pharmacy)

24. Dr. Justin Lacombe, July 2006-July 2007, now with Teva.
25. Dr. Elizabeth Chen, Sept 2003-June 2005, currently with Colorcon
26. Dr. Christopher Goodridge, September 2000-Sept 2002 currently with GSK
27. Dr. Albert Alexander IV, Sept 1999-June 2004, currently with AZ
28. Dr. Troy Shinbrot, Aug. 1999-June 2002 currently an Associate Professor at Rutgers, Biomedical Engineering Department
29. Dr. Erik Van Doorn, April 1999 – February 2000,
30. Dr. Michael Roddy, January 1996-December 1996, currently with Procter and Gamble
31. Dr. Maher Moakher, Research Associate, June 1995-July 1998, currently at ETH
32. Dr. Paul Swanson, April 1994-April 1997, currently with Simulation Sciences
33. Dr. Dean Brone, Oct. 1993-July 98, currently with Sunovion
34. Dr. Paul Mort, Aug. 1993-Oct. 1993, currently with Procter and Gamble
35. Dr. Minye Liu, July 1992-June 1995, currently with the Dow Chemical Company

Doctoral dissertations supervised.

1. Plamen Grigorov (2019) – now at Merck
2. Sebastian Escotet (2019) – now at Merck
3. Dr. Yifan Wang (Currently at FDA)
4. Dr. Sarang Oka (Ph.D. 2016) – currently with Hovione
5. Dr. Pallavi Pawar (Ph.D. 2016) – currently at GSK
6. Dr. Krizia Karry (Ph.D. 2015) – currently at BASF
7. Dr. Sara Koynov (Ph.D. 2015) – now at Merck
8. Dr. Juan Osorio (Ph.D. 2014) – now at BMS
9. Dr. Willam Engisch (Ph.D. 2014) – now at Amgen
10. Dr. Eric Jayjock (Ph.D. 2011), now at Patheon
11. Dr. Fani Boukouvala (Ph.D. 2012), Currently at Texas A&M
12. Dr. Yijie Gao (Ph.D. 2012), Currently at Millenium Pharmaceuticals
13. Dr. Aditya Vanarase, Ph.D. 2011, currently with Bristol Myers Squibb
14. Dr. Alisa Vasilenko (Ph.D. 2011), currently at L'Oreal
15. Dr. Marcos Llusa (PhD 2008), currently at RCPE, Graz, Austria
16. Dr. Patricia Portillo (PhD 2008), currently at L'Oreal
17. Dr. Amit Mehotra (Ph.D. 2007), currently with Glaxo Smith Kline
18. Dr. Abdulmobeen Faqui, (Ph.D.2006)
19. Dr. Justin Lacombe (Ph.D. 2006)
20. Dr. Joseph Kukura (Ph.D. 2004), currently at Merck
21. Dr. Jennifer Baxter (Ph.D. 2004), currently at Merck
22. Dr. Edit Ambrozy (Ph.D. 2003)
23. Dr. Paulo Arratia (Ph.D. 2003), currently a tenured Professor at the University of Pennsylvania Dept. of Mech. Engineering
24. Dr. Nhat-Hang Duong (Ph.D. 2003), currently at GSK
25. Dr. Osama Sudah (Ph.D. 2001), currently at Merck
26. Dr. Albert Alexander IV, (Ph.D. 2001), currently with Astra-Zeneca
27. Dr. Jeffrey Zalc (Ph.D. 2000), currently at Monsanto
28. Dr. Mario Alvarez (Ph.D. 2000), currently a full Tenured professor at Universidad Autonoma de Mexico
29. Dr. Stefano Cerbelli (Ph.D. 1999), currently an assistant professor at the University of Rome
30. Dr. David Unger (Ph.D. 1999), currently with Cephalon
31. Dr. Pamela Wright (Ph.D. 1999)
32. Dr. David Lamberto (Ph.D. 1998), currently with Merck
33. Dr. Michael D. Hobbs (Ph.D. 1998), currently with BMS
34. Dr. Carolyn Wightman (Ph.D., 1997), currently with Merck
35. Dr. Mark R. Riley (Ph.D. 1995), currently a Professor at Arizona State University

Master's theses supervised as primary advisor

Zhanjie Liu (M.S. 2015)
Abhishek Sahay (M.S. 2012)
Mr. Wei Meng (M.S. 2014)
Ms. Wiphusanne Dendamrongvit (M.S. 2013)
Mr. Kevin Connor (M.S. 2004) e
Mr. Kurt Sturm (M.S. 2003)
Ms. Erinn Gleason (M.S. 1998)
Ms. Anna Zavlina (M.S. 1995)
Mr. Kiran Kumar (M.S. 1993)