

Faculty

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Rank/Discipline

Assistant Professor
Industrial Pharmacy

Education & Specialty Certification

Post-doctoral Associate, MIT, 2012-2014; Assistant Professor (Habilitation), Martin Luther University Halle-Wittenberg, Germany, 2009-2012; PhD, Martin Luther University Halle-Wittenberg, Germany, 2005-2009.

Torsten Stelzer, Ph.D.

Research Areas and Active Projects

The Stelzer Research Group is focusing on pharmaceutical crystallization with an emphasis on small-scale manufacturing from purification and separation to novel formulation techniques. Our research addresses the needs of the pharmaceutical industry and bridges the gap between academic and industrial research and development with the aid of experimental and model-driven design tools. The specific areas of interest are:

- Crystallization from solution and melt of small and macro (protein) molecules
 - Nucleation and control of polymorphism
 - Liquid-liquid phase separation and control
 - Novel continuous formulation techniques
 - Development and optimization of batch and continuous processes
 - Case studies: bulk chemicals, fine chemicals, pharmaceuticals, biopharmaceuticals, food chemicals, etc.
- Process intensification
 - Design and optimization of novel manufacturing equipment
 - Development of new manufacturing methods (multi-functional, hybrid)
 - Case studies of process intensification
- Small-scale manufacturing
 - Purification, separation, and formulation
 - Integration of sensors and detectors for process analytical technology (PAT)
 - Case studies of small-scale manufacturing

At the interface of Chemistry, Engineering, and Pharmaceutical Sciences our laboratory offers a unique multidisciplinary work environment by combining student training and fundamental research with an application-driven technology platform dedicated to the miniaturization of pharmaceutical manufacturing and the transfer of knowledge through strong academic/industrial collaborations.

Publications

Peer Reviewed Journal Contributions

Pertig, D., Fardmostafavi, M., **Stelzer, T.**, Ulrich, J.: "Monitoring Concept of Single-frequency Ultrasound and its Application in Dynamic Crystallization Processes", *Adv. Powder Tech.* **2015**, DOI: 10.1016/j.appt.2015.03.001.

Cui, Y., Jaramillo, J.J., **Stelzer, T.**, Myerson, A.S.: "Statistical Design of Experiment on Contact Secondary Nucleation as a Means of Creating Seed Crystals for Continuous Tubular Crystallizers", *Org. Process Res. Dev.*, **2014**, DOI: 10.1021/op500229a.

Stelzer, T., Pertig, D., Ulrich, J.: "Ultrasonic Crystallization Monitoring Technique for Simultaneous in-line Measurement of Liquid and Solid Phase", *J. Cryst. Growth*, **2013**, 362, 71-76.

Ulrich, J., Schuster, A., **Stelzer, T.**: "Crystalline Coats or Hollow Crystals as Tools for Product Design in Pharmaceutical Industry", *J. Cryst. Growth*, **2013**, 362, 235-237.

Mueansichai, T., Flood, A. E., **Stelzer, T.**, Ulrich, J.: "Rate of sodium chloride attrition fragment generation in a mixed-suspension crystallizer", *Cryst. Res. Technol.*, **2013**, 48, 38-50.

Hellstén, S., Han, B., Mäkilä, E., Niemi, H., Salonen, J., Lehto, V.-P., **Stelzer, T.**, Louhi-Kultanen, M., Ulrich, J.: "Insights into the Evaporation Kinetics of Indomethacin Solutions", *Chem. Eng. Technol.*, **2013**, 36, 1300-1306.

Detle, S.S., Sanselme, M., **Stelzer, T.**, Renou, L., Jones, M.J., Couvrat, N., Coquerel, G., Ulrich, J.: "Structural Investigation on Sodium-2-Keto-L-Gulonate-Monohydrate", *J. Mol. Struct.*, **2012**, 1020, 121-126.

Helmdach, L., Pertig, D., Rüdiger, S., Lee, K.-S., **Stelzer, T.**, Ulrich, J.: "Bubbles – Trouble-Makers in Crystallizers Classical Problems during Inline Measurements", *Chem. Eng. Technol.*, **2012**, 35, 1017-1023.

Martins, D., **Stelzer, T.**, Ulrich, J., Coquerel, G.: "Formation of Crystalline Hollow Whiskers as Relics of Organic Dissipative Structures", *Cryst. Growth Des.*, **2011**, 11, 3020-3026.

Pertig, D., Buchfink, R., Petersen, S., **Stelzer, T.**, Ulrich, J.: "In-line Analyzing of Industrial Crystallization Processes by an Innovative Ultrasonic Probe Technique", *Chem. Eng. Technol.*, **2011**, 34, 639-646.

Wachsmuth, A., **Stelzer, T.**, Ulrich, J.: "Decreasing the Diameter of Crystalline Tubes and an Approach to Explain its Nucleation", *Chem. Eng. Technol.*, **2011**, 34, 578-582.

Schuster, A., **Stelzer, T.**, Ulrich, J.: "The Generation of Crystalline Hollow Needles: New Approach by Liquid-liquid Phase Transformation", *Chem. Eng. Technol.*, **2011**, 34, 599-603.

Ulrich, J., **Stelzer, T.**: "Industrial Crystallization: Still a vivid topic!", *Chem. Eng. Technol.*, **2011**, 34, 499, guest editor.

Rößler, M., **Stelzer, T.**, Ulrich, J.: "Investigation of Water Adsorption of Crystalline Fertilizer", *Chem. Ing. Tech.*, **2011**, 83, 652-657.

Rüdiger, S., **Stelzer, T.**, Ulrich, J.: „Werkzeuge für's Produktdesign - Industrielle Kristallisation vom Molekül bis zur Anlage“, *CIT Plus*, **2011**, 9, 30-31.

Stelzer, T., Ulrich, J.: "Crystallization a Tool for Product Design", *Adv. Powder Technol.*, **2010**, 21, 227-234, invited review.

Stelzer, T., Ulrich, J.: "No Product Design without Process Design (Control)?", *Chem. Eng. Technol.*, **2010**, 33, 723-729, review.

Schuster, A., **Stelzer, T.**, Petersen, S., Ulrich, J.: "Closed Crystalline Tubes as a Container System", *Chem. Eng. Technol.*, **2010**, 33, 787-790.

Dette, S.S., **Stelzer, T.**, Jones, M. J., Coquerel, G., Ulrich, J.: "Fascinating control of crystalline microstructures", *Chem. Eng. Res. Des.*, **2010**, 88, 1158-1162.

Dette, S.S., **Stelzer, T.**, Jones, M. J., Ulrich, J.: "Dehydration behavior of hydrates", *Cryst. Res. Technol.*, **2010**, 45, 697-702.

Stelzer, T.: „Was gibt es neues im Bereich der Kristallisation?“, *Chem. Ing. Tech.*, **2009** 81, 1348-1350.

Stelzer, T., Ulrich, J.: "Is control of the storage stability of fertilizer granules by additives feasible? ", *Chem. Ing. Tech.*, **2008**, 80, 1825-1830.

Dette, S.S., **Stelzer, T.**, Römbach, E., Jones, M. J., Ulrich, J., "Controlling the internal diameter of nanotubes by changing the concentrations of the antisolvent", *Cryst. Growth Des.*, **2007**, 7, 1615-1617.

Book Contributions

Ulrich, J., **Stelzer, T.**: "Melt Crystallization", in *Handbook of Industrial Crystallization*, 3rd edition, eds. Myerson, A., Lee, A., Erdemir, D., *in press*.

Ulrich, J., **Stelzer, T.**: "Melt Crystallization", in *Crystallization - Basic*

Concepts and Industrial Applications, edited by W. Beckmann, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, **2013**, 289-304.

Ulrich, J., **Stelzer, T.**: "Design Examples of melt Crystallization", in *Crystallization - Basic Concepts and Industrial Applications*, edited by W. Beckmann, Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, **2013**, 325-335.

Ulrich, J., **Stelzer, T.**: "Crystallization", in *Kirk-Othmer Encyclopedia of Chemical Technology*, John Wiley & Sons, Inc., **2011**, Online-publication: DOI:0.1002/0471238961.0318251918152119.a01.pub3.

Proceedings

Stelzer, T., Ulrich, J.: "Proceedings BIWIC 2010-17th International Workshop on Industrial Crystallization-", Cuvillier Verlag, Göttingen, 2010.

Patents

Jensen, K.F., Jamison, T., Myerson, A., **Stelzer, T.**, Wong, S.Y., Chen, J., Revalor, E., Zhang, P., Snead, D., Adamo, A., Behnam, M., Monbaliu, J.-C., Weeranoppanant, N.: "Systems and Methods for Synthesizing Chemical Products, Including Active Pharmaceutical Ingredients", *patent pending, U.S. Provisional Application No.: 62/038,039, 2014.*

Petersen, S., Wendt, K., Abouzeid, A., Hartwig, A., **Stelzer, T.**, Ulrich, J.: "Process and Device for Manufacture of coated Granules, Pastilles or Tablets via In-situ Coating", *patent pending, B01J 2/02, 2014.*

Stelzer, T., Pertig, D., Ulrich, J.: "Method for controlling crystallization process of dissolved substances in liquid solution, involves determining changes in propagation velocity, size and suspension density of dissolved particles based on change in process parameters", *DE 102011051321 (A1), 2012.*

Presentations

Stelzer, T., Wong, S.Y., Chen, J., Myerson, A.S.: "Ultrasound a Versatile Process Analytical Tool for Quantitative in-line Monitoring of Pharmaceutical Oral/Injection Formulations", in *Proc. of 19th ISIC*, Toulouse, France, September 16-19, **2014**, poster.

Stelzer, T., Wong, S.Y., Chen, J., Myerson, A.S.: "Quantitative in-line Monitoring of Pharmaceutical Formulations by Ultrasound", *Ultrasonics-2014*, Lisbon, Portugal, September 14-17, **2014**, invited speaker.

Stelzer, T., Wong, S.Y., Chen, J., Myerson, A.S.: “Quantitative in-line Monitoring of Pharmaceutical Formulations by Ultrasound”, IFPAC/QbD/PAT-2014 Summer Summit, San Juan, Puerto Rico, June 17-18, **2014**, invited speaker.

Wendt, K., Petersen, S., Abouzeid, A., Bergt, K., **Stelzer, T.**, Ulrich, J.: “In-situ-Coating- Konzept eines alternativen Beschichtungsverfahrens”, *ProcessNet-Fachausschuss Kristallisation*, Magdeburg, Germany, March 14-15, **2013**, presentation.

Castro-Prescher, M., **Stelzer, T.**, Ulrich, J.: “Fremdstoffeinfluss auf die Kristallisation von $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ ”, *ProcessNet-Fachausschuss Kristallisation*, Magdeburg, Germany, March 14-15, **2013**, presentation.

Bergt, K., Wendt, K., Abouzeid, A., Petersen, S., **Stelzer, T.**, Ulrich, J.: “In situ coating – A promising technology in production of coated tablets or granules”, in *Proc. of HIW 2012 - International Workshop on Industrial and Pharmaceutical Crystallization*, ed. Kim, K.-J., Deajeon, South Korea, September 03-05, **2012**, presentation.

Stelzer, T., Dette, S.S., Sanselme, M., Renou, L., Jones, M.J., Couvrat, N. Coquerel, G., Ulrich, J.: “Engineering of Crystalline Containers by Structure Reorganization”, Gordon Conference: Crystal Engineering, Waterville Valley, USA, June 10-15, **2012**, poster.

Pertig, D., **Stelzer, T.**, Ulrich, J.: “In-Situ Monitoring of Industrial Sugar Crystallization Processes by Single-Frequency Ultrasound”, *ACHEMA 2012*, Frankfurt, Germany, June 18-22, **2012**, presentation.

Schuster, A., **Stelzer, T.**, Ulrich, J.: “Investigations on the Formation of Hollow Acicular Crystals as Container Systems”, *ACHEMA 2012*, Frankfurt, Germany, June 18-22, **2012**, presentation.

Wachsmuth, A., **Stelzer, T.**, Ulrich, J.: “Preventing undesired Phase Transformation by Additives”, *ProcessNet-Fachausschuss Kristallisation*, Wittenberg, Germany, March 05-06, **2012**, poster.

Schuster, A., **Stelzer, T.**, Ulrich, J.: “Investigations on acicular crystalline containers as innovative coating procedure”, *ProcessNet-Fachausschuss Kristallisation*, Wittenberg, Germany, March 05-06, **2012**, presentation.

Stelzer, T., Pertig, D., Ulrich, J.: “Ultrasound Technique as Tool to Monitor In-line Liquid and Solid Phase of Industrial Crystallization Processes”, in *Proc. of ICMAT 2011 and 5th CGCT*, Material Research Society, Singapore, 2011, pp. 13-14., Singapore, June 26-30, **2011**, presentation.

Helmdach, L., Pertig, D., Rüdiger, S., Lee, K. S., **Stelzer, T.**, Ulrich, J.: "Bubbles – Trouble-Makers in Crystallizers – Classical Problems During Inline Measurements", in *Proc. of 18th BIWIC*, eds. Kadam, S. S., Kulkarni, S. A., ter Horst, J. H., Delft University of Technology, Delft, 2011, pp. 7-13., Delft, The Netherlands, September 07-09, **2011**, presentation.

Hellstén, S., Mäkilä, E., Salonen, J., Lehto, V.-P., **Stelzer, T.**, Louhi-Kultanen, M., Ulrich, J.: "Evaporation Kinetics Study of Mesoporous Silicon Particles with API Loaded Solutions", in *Proc. of 18th BIWIC*, eds. Kadam, S. S., Kulkarni, S. A., ter Horst, J. H., Delft University of Technology, Delft, 2011, pp. 245-250, Delft, The Netherlands, September 07-09, **2011**, poster.

Wachsmuth A., **Stelzer T.**, Ulrich J.: "Improving the Stability of Crystalline Tubes", in *Proc. of 18th ISIC, AIDIC*, Milan, 2011, pp. 78-79, Zurich, Switzerland, September 13-16, **2011**, presentation.

Pertig D., **Stelzer T.**, Ulrich J.: "Improved Correlations of Single-Frequency Ultrasound Velocity and Attenuation to Most Important Suspension Properties via Phenomenological Models", in *Proc. of 18th ISIC, AIDIC*, Milan, 2011, pp. 158-159, Zurich, Switzerland, September 13-16, **2011**, presentation.

Schuster A., **Stelzer T.**, Ulrich J.: "Hollow Crystalline Needles: Filled and Closed", in *Proc. of 18th ISIC, AIDIC*, Milan, 2011, pp. 369-370, Zurich, Switzerland, September 13-16, **2011**, poster.

Rößler, M., **Stelzer T.**, Ulrich J.: "Improving separation efficiency in solid layer crystallization process by controlled nucleation", in *Proc. of 18th ISIC, AIDIC*, Milan, 2011, pp. 421-422, Zurich, Switzerland, September 13-16, **2011**, poster.

Stelzer T., Ulrich J.: "Roughness – What does the term mean?", *8th ECCE, Process Net-Annual Meeting, 1st ECAB and 29th DECHEMA's Biotechnology Annual Meeting*, Berlin, Germany, September 25-29, **2011**, presentation.

Pertig, D., Buchfink, R., Petersen, S., **Stelzer, T.**, Ulrich, J.: "In-line analyzing of industrial crystallization processes by innovative ultrasonic probe technique", in *Proc. of 17th BIWIC*, eds. Stelzer, T., Ulrich, J., Cuvillier Verlag, Göttingen, 2010, pp. 78-89, Halle, Germany, September 08-10, **2010**, presentation.

Rößler, M., **Stelzer, T.**, Ulrich, J.: "Investigation of water adsorption of crystalline fertilizer", in *Proc. of 17th BIWIC*, eds. Stelzer, T., Ulrich, J., Cuvillier Verlag, Göttingen, 2010, pp. 419-425, Halle, Germany, September 08-10, **2010**, poster.

Wachsmuth, A., **Stelzer, T.**, Ulrich, J.: "Decreasing the diameter of crystalline tubes", in *Proc. of 17th BIWIC*, eds. Stelzer, T., Ulrich, J., Cuvillier Verlag, Göttingen, 2010, pp. 495-499, Halle, Germany, September 08-10, **2010**, poster.

Martins, D., **Stelzer, T.**, Ulrich, J., Coquerel, G.: "A new example of dissipative structure: Crystalline Hollow whiskers", *CGOM9*, Singapore, August 04-07, **2010**, presentation.

Stelzer, T., Ulrich, J.: "Shelf life of granules – what about surface roughness?", in *Proc. of WCPT6 2010*, ed. NürnbergMesse GmbH, CD, Nuremberg, Germany, April 26-29, **2010**, presentation.

Heinrich, J., **Stelzer, T.**, Ulrich, J.: "Crystallization Kinetics of α -Ammonium Chloride monitored by in-situ Measurement Techniques", in *Proc. of WCPT6 2010*, ed. NürnbergMesse GmbH, CD, Nuremberg, Germany, April 26-29, **2010**, poster.

Mueansichai, T., Flood, A. E., **Stelzer, T.**, Ulrich, J.: "Scale up Effect on Attrition of Sucrose Crystals in Batch Crystallizers", in *Proc. of 16th BIWIC*, eds. Louhi-Kultanen, M., Hataka, H., LUT, Lappeenranta, 2009, pp. 110-116, Lappeenranta, Finland, September 09-11, **2009**, presentation.

Stelzer T., Dette, S.S., Jones, M. J., Wachsmuth, A., Schuster, A., Ulrich, J.: "On the Nucleation of Needle Crystals", in *Proc. of 16th BIWIC*, eds. Louhi-Kultanen, M., Hataka, H., LUT, Lappeenranta, 2009, pp. 272-278, Lappeenranta, Finland, September 09-11, **2009**, poster.

Stelzer, T., Ulrich, J.: „Produktentwicklung eines kristallinen Düngers“, *ProcessNet-Fachausschuss Kristallisation*, Dortmund, Germany, March 12-13, 2009, presentation.

Dette, S.S., **Stelzer, T.**, Jones, M. J., Renou, L., Coquerel, G., Ulrich, J.: „Fascinating control of crystalline microstructures“, in *Proc. of 17th ISIC and CGOM8*, eds. Jansens, P. J., Ulrich, J., Technologisch Instituut Vzw, 2008, Vol. 1, pp. 377-383, Maastricht, The Netherlands, September 14-17, **2008**, presentation.

Stelzer, T., Ulrich, J.: "Morphology and shelf life of a crystalline fertilizer – the influence of $\text{Al}(\text{OH})_3$ ", in *Proc. of 17th ISIC and CGOM8*, eds. Jansens, P. J., Ulrich, J., Technologisch Instituut Vzw, 2008, Vol. 2, pp. 1241-1248, Maastricht, The Netherlands, September 14-17, **2008**, poster.

Stelzer, T., Ulrich, J.: "Control the shelf life of fertilizer granules by additive?", *2nd Wittenberger AgroChemie-Workshop*, Wittenberg, Germany, March 14, **2008**, poster.

Dette, S.S., **Stelzer, T.**, Jones, M. J., Ulrich, J.: „Ist das Erzeugen von hohlen kristallinen Nadeln aus allen Solvaten möglich?“, *ProcessNet-Fachausschuss Kristallisation*, Halle, Germany, March 05-07, **2008**, presentation.

Stelzer, T., Ulrich, J.: “In control of the storage stability of fertilizer granules by additives feasible?“, *ProcessNet-Fachausschuss Kristallisation*, Halle, Germany, March 05-07, **2008**, poster.

Stelzer, T., Ulrich, J.: “Strategy to improve the shelf life of crystalline fertilizers”, in *Proc. of 14th BIWIC*, Eds. Lewis, A.E., Olson, C., IOS Press, Amsterdam, 2007, pp. 73-80, Cape Town, South Africa, September 09-11, **2007**, presentation.

Stelzer, T., Ulrich, J.: “The influence of impurities in feed materials on product properties”, in *Proc. of 13th BIWIC*, Eds. Jansens, P.J., ter Horst, J.H., Jiang, S., IOS Press, Amsterdam, 2006, pp. 43-50, Delft, The Netherlands, September 13-15, **2006**, presentation.

Dette, S.S., **Stelzer, T.**, Römbach, E., Jones, M. J., Ulrich, J.: “Controlling the internal diameter of nanotubes by changing the concentrations of the antisolvent”, *CGOM7*, Rouen, France, August 27-31, **2006**, presentation.

Stelzer, T., Ulrich, J.: “Processes influencing crystal morphology in the crystallization of urea based fertilizer”, *1st Wittenberger Agro-Chemie-Workshop*, Wittenberg, Germany, March 15, **2006**, poster.

Warstat, A., **Stelzer, T.**, Ulrich, J.: “Seeding during batch crystallization – scale up experiments”, in *Proc. of 12th BIWIC*, Eds. Jones, M., Ulrich, J., Martin Luther-University Halle-Wittenberg, Halle, 2005, pp. 116-124, Halle, Germany, September 07-09, **2005**, presentation.