



Takashi MIKAMI, Dr. Eng.

Associate Professor

Program: Advanced Materials Science and Technology

Area: Applied Chemistry and Chemical Engineering

Undergraduate: Department of Engineering

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Professional Expertise

His professional expertise is industrial crystallization technology to obtain desired crystalline products. Crystallization is one of the mass transfer operations in chemical engineering to separate crystalline solids from solutions and widely used in many industrial fields. His special interest is producing monodisperse nano/micro crystals of high valued chemicals such as active pharmaceutical ingredients (APIs) and inorganic fillers for composite materials. For precise design of crystalline qualities, he believes that some methodologies of powder technology are useful and combination with industrial crystallization techniques. MIKAMI group has continued to develop industrial crystallization technologies including powder technology for producing high valued crystalline materials.

Research Fields of Interest

-Pharmaceuticals

For producing active pharmaceutical ingredients (APIs), solubility in human body is important issue (viz. bioavailability). Bioavailability of APIs depends on crystalline qualities such as crystal size distribution, morphology and purity. Monodisperse nano/micro crystals of APIs have good bioavailability due to facile dissolution in human body, and they enable to dose to desired locations in the human body. MIKAMI group has studied on industrial crystallization technologies of controlled cooling and anti-solvent addition to obtain monodisperse nano/micro crystals of APIs.

-Reactive crystallization

Monodisperse nano/micro crystalline particles are widely used in many industries such as fillers, pigments, catalysts and pharmaceuticals due to the uniformity in physico-chemical properties. Controlled double-jet reactive crystallization is a suitable method to obtain monodisperse nanocrystals of inorganic compounds due to successful nucleation/growth separation. And polyelectrolyte additives such as PAA and PEI have a role of growth inhibitor for sulphates (e.g. PbSO_4 , SrSO_4 and BaSO_4) and carbonates (e.g. CaCO_3) to cause monodisperse nanocrystals. MIKAMI group has clarified the effectiveness of polyelectrolyte addition on reactive crystallization of monodisperse nano/micro crystals.

-Powder technology

Downstream processes (i.e. filtration and drying) are also important in general crystallization processes. Powder technology is a powerful methodology to design overall crystallization processes. And it helps to understand some important phenomena in crystallization systems such as breakage and attrition. Additionally, crystallization is a build-up technology for the production of powder products with desired particulate properties. MIKAMI group has tried to apply ideas of powder technology to crystallization engineering.

Education

2010: D.Eng., Graduate School of Science and Engineering, Waseda university, Japan

2007: M.Eng., Graduate School of Science and Engineering, Waseda university, Japan

2005: B.Eng., School of Science and Engineering, Waseda university, Japan

Professional Societies and Activities

1. Member of the Society of Chemical Engineers, Japan
2. Member of the Society of Separation Process Engineers, Japan
3. Member of the Society of Sea Water Science, Japan
4. Member of Japanese Society for Engineering Education

Awards

1. "Intelligent-cosmos Award", Intelligent-cosmos incorporated foundation, 2012
2. "Mizuno Award", Waseda university (2010)

Major Publications

Papers

- [1] "Kinetic study on PEI-assisted reactive crystallization of monodisperse strontium sulfate microcrystals", *Chemical Engineering & Technology*, vol.36, no.8, pp.1320-1326, 2013.
- [2] "Single-Jet Precipitation of Silver Nanocrystals in the Presence of Poly(acrylic acid)", *Chemical Engineering & Technology*, vol.35, no.4, pp.700-704, 2012.
- [3] "Influence of Polyethylenimine Addition on Crystal Size Distribution of Au Nanocrystals", *Chemical Engineering & Technology*, vol.34, no.4, pp.583-586, 2011.
- [4] "Influence of Polyethylenimine on Double-Jet Reactive Crystallization Process of Monodisperse BaSO₄", *Journal of Chemical Engineering of Japan*, vol.43, no.8, pp.698-703, 2010.
- [5] "PEI-assisted preparation of Au nanoparticles via reductive crystallization process", *Chemical Engineering Research and Design*, vol.88, no.5, pp.1248-1251, 2010.
- [6] "CSD-controlled reactive crystallization of SrSO₄ in the presence of polyethylenimine", *Chemical Engineering Research and Design*, vol.88, no.5, pp.1200-1205, 2010.
- [7] "Polyelectrolyte-Assisted Reactive Crystallization of SrSO₄ to Obtain Monodispersed Nano/Micro-Particles", *Chemical Engineering & Technology*, vol.33, no.5, pp.797-803, 2010.
- [8] "Quality-Controlled Reactive Crystallization of SrSO₄ to Produce High-Valued Chemicals", *Chemical Engineering & Technology*, vol.33, no.5, pp.775-779, 2010.
- [9] "Control of CSD Width via PEI-Assisted Reactive Crystallization of Micro-SrSO₄ Particles", *Journal of Chemical Engineering of Japan*, vol.43, no.3, pp.308-312, 2010.
- [10] "Effect of Feeding Condition on Crystal Size Distributions of Mono-Dispersed SrSO₄ Particles Produced via PEI-Assisted Double-Jet Reactive Crystallization", *Journal of Chemical Engineering of Japan*, vol.43, no.3, pp.300-307, 2010.
- [11] "Strategy to Obtain nm Size Crystals through Precipitation in the Presence of Polyelectrolyte", *Chemical Engineering & Technology*, vol.29, no.2, pp.212-214, 2006.

Proceedings

- [1] "Batch crystallization of aspirin to obtain monodisperse pharmaceutical crystals", *Proceedings of 19th International Workshop on Industrial Crystallization*, pp.484-489, 2012.
- [2] "Strategy to obtain monodisperse nano/micro crystals via polyelectrolyte-assisted reactive crystallization", *Proceedings of 1st Asian Crystallization Technology Symposium*, p.26, 2012.
- [3] "Kinetic study on PEI-assisted reactive crystallization of monodisperse strontium sulfate microcrystals", *Proceedings of 18th International Symposium on Industrial Crystallization*, p.114, 2011.
- [4] "Reductive crystallization of Au nanoparticles on PEI-dosed silica", *Proceedings of 17th International Workshop on Industrial Crystallization*, pp.363-368, 2010.
- [5] "Reductive crystallization of Au nanoparticles in the presence of polyethylenimine", *Proceedings of 17th International Workshop on Industrial Crystallization*, pp.358-362, 2010.
- [6] "PEI-Mediated Preparation of Au Nanoparticles via Reductive Crystallization Process", *Proceedings of 16th International Workshop on Industrial Crystallization*, pp.253-257, 2009.
- [7] "Polyelectrolyte-Assisted Reactive Crystallization of SrSO₄ to Obtain Mono-dispersed Nano/Micro Particles", *Proceedings of 16th International Workshop on Industrial Crystallization*, pp.15-22, 2009.
- [8] "Controlled Reactive Crystallization of Mono-dispersed Micro-SrSO₄ in the presence of Polyethylenimine", *Proceedings of 5th Joint China/Japan Chemical Engineering Symposium*, Session3, O-01, 2009.