



Summary of Track 2: Particle Design – Formulation and Processing

Yongsheng Han

Institute of Process Engineering, Chinese Academy of Sciences, Beijing, China

This track was organized by Professor Jianfeng Chen from Beijing University of Chemical Engineering (Focusing on the topic of particle morphology and size control), Prof. Dan Wang from Institute of Process Engineering, Chinese Academy of Science (Focusing on the topic of nano and superfine particles), Prof. Guanghui Ma from Institute of Process Engineering, Chinese Academy of Science (Focusing on the topic of biological particles), Prof. Fude Cui from Shenyang Pharmaceutical University (Focusing on the topic of pharmaceutical particles), Prof. Chunzhong Li from East China University of Science and Technology (Focusing on the topic of new approaches for particle preparation). Track 2 focuses on the particle design in formulation and processing, covering the areas of synthesis, characterizations and applications. More than 200 oral talks and nearly 80 posters were presented and the following issues have been highlighted:

Particles Size and Morphology

In the last decade, the nanosized particles have attracted great attention due to their unique properties and potential applications. With the development of nanoscience, researchers have gradually come out from the fetishism on nano. In stead, they put more effort in the scale up and application of nanoparticles. In this congress, Prof. Jianfeng Chen (from Beijing University of Chemical Engineering, China) reported their strategy to produce nanoparticles with massive production at low cost by the high gravity controlled precipitation technology (HGCP). The morphology is another important issue of particles. Various morphology-dependent properties have been found in the study of nanoscience, which promises that morphology control is the next big thing in nanoscience. The core/shell particles and two-dimensional particles have been highlighted by Prof. Zhiyong Tang (from National Center for Nanoscience and Technology, China) and Prof. Hua Zhang (from Nanyang Technological University, Singapore) respectively. Prof. Wolfgang Peukert (from University of Erlangen, Germany) gave a keynote talk on the design and controlled synthesis of hierarchical structures. The scientists from Institute of Process Engineering, CAS presented their original study on the control of hierarchical structures via regulating the chemical diffusion and reaction.

Particles Preparation and Characterization

Except the traditional methods for particles preparation, several new approaches have been reported in this congress. Prof. Yeukung Hwu (from Academia Sinica, Taiwan, China) gave a keynote talk on the synthesis of nanoparticles by X-rays which was used to reduce metallic ion precursors and achieved accurate control on the nucleation process, the size and shape of particles. Prof. Changjun Liu (from Tianjin University, China) used electron as a reducing agent to produce nanostructured particles. He pointed out that the electron is the greenest reducing agent for materials preparation. Besides, microfluidic systems were highlighted by Prof. Guangsheng Luo (from Tsinghua University, China) and Prof. Liangyin Chu (from Sichuan University, China) for the preparation of functional polymeric particles. Prof. Jukka Rantanen (from University of Copenhagen, Denmark) gave a review on the innovative manufacturing of future pharmaceuticals in which he pointed out that the flexible processing based on continuous manufacturing is needed for enabling on-demand manufacturing of personalized

products with tailor-made characteristics according to individual needs. For the issue of particle characterization, the term “*in-situ*” has attracted great attention. Dr. Doris Segets (from University of Erlangen, Germany) reported their study of the *in situ* characterization on particles size. Another impressive report was given by Mr. K Gao who is a PhD student of Karlsruhe Institute of Technology. He used an *in situ* transition electron microcopy to observe the movement of metal cluster on the surface of oxide support, clarifying the debate of years on the transport routes of metal catalyst on support. The *in situ* characterization on the materials formation and application processes is expected to open the black boxes which impedes our understanding on many microscopic phenomena.

Particles Applications

The bright future promised by nanoparticles is the driving force for the continuous effort in discovering nanotechnology. Bio and energy applications are two majorities in this congress. A team from Prof. Guanghui Ma (from Institute of Process Engineering, CAS, China) has focused on the application of different particles in the field of pharmaceuticals. Another interesting talk was from Prof. Woo Sik Choi (from Pusan National University, South Korea) who reported their study on the healing practices and the user experience for pillows and mattress using loess ball bio-product. Besides, cancer targeting has received great attention on both *in vivo* and *in vitro* studies. The reports on energy application include but not limited catalysis and energy storage. A team from Prof. Chunzhong Li (from East China University of Science and Technology, China) reported their studies on the controlled synthesis of oxides for lithium ion batteries. Prof. Jian Liu (from Curtin University, Australia) gave an invited talk on nanoporous colloidal carbon spheres for energy applications. The new ideas in designing and applying particles promises a solution to improve the efficiency of recyclable energy devices, finally leading to a green and sustainable approach to face the energy crisis.

To sum up, particles are still hot topics in the fields of nanomaterials. Except the control on particles size and the preparation of new morphologies, the fundamental study on the controllable synthesis and the advanced applications in energy and environments have attracted great attentions. All these works will push the development of particles materials and make them benefits to our life.