

Preparation of Nanosized Ceramic Powders and Their Surface Design

Prof. Yunfa Chen
Institute of Process Engineering
Chinese Academy of Sciences

The synthesis of nanosized ceramic powders have been classified into two broad categories according to the strategies used in the process: bottom-up and top-down. In the first case, nanoparticles are built up atom by atom, or molecule by molecule. Most of the nanoparticle syntheses belong to this category. In our institute, the most effort has been also paid in this field.

The challenges in manufacturing nanosized powders are to control their size, size distribution, morphology, crystallinity, property and to make them with a variety of materials at large volume and a reasonable cost. During the past decade, our institute has contributed to the development of the industrial products of many kinds of ceramic powders in China, such as nanosized SiO_2 , TiO_2 , ZnO , Al_2O_3 , ZrO_2 , and magnetic, antibacterial powders. Some of these powders have also successfully used in the fibers, cosmetics, plastics, paintings et al. In my lecture, our attempts and experience in the scaling-up of the nanosized powders preparation and their application will be presented. The synthesis methods such as plasma, chemical coprecipitation, chemical reduction in fluid bed, thermal spray will be mainly addressed, with the emphasis on the key processes such as the liquid-solid separation and thermal treatment of the precipitates.

Although there exist more than 30 production lines of nanosized powders with a production scale of more than 20 tons/year in China, their application in practice has been hindered by many factors, in which the agglomeration of the powder and their surface properties being the important ones. So in the second part of the lecture, I will report and explain our proceeding efforts on the development of new equipment for organically modification of the powder and the process design to create new inorganic layer on the surface of the ceramic particle (the preparation of core-shell structured functional particles).

As the final part, I would like to present the Korea scientists and engineers the development and application of nanosized ceramic powders in China and report what kinds of new product we are manufacturing and national policy/projects we are considering and putting in practice.