

# Emerging particle technologies

## New tools and a new horizon

It's no secret that until recently Japan and Europe have been ahead of the United States in the technologies and techniques associated with powder and particle technology. The United States has picked up the pace, however, and is moving toward leadership positions in a number of areas.

That was apparent at the 3rd World Congress of Particle Technology held in Brighton, England, in early July. More than 700 researchers gathered from around the world to present the latest developments in measurement and on-line control, particle interactions and assembly mechanics, agglomeration and growth, dispersion/rheology/mixing, comminution and attrition, particle formation, multiphase flow, powder mechanics/storage and flow, particle/fluid separation and drying, high-performance particles and new processes.

### New tools for industry

Advances in particle characterization, measurement and on-line control are helping people in the plants run processes more efficiently.

In a paper on "Industrial Applications of In-Line Particle Characterization," Dupont engineers report that recent advances in sensor technology have made in-line particle characterization possible in a number of industrial processes, including milling, crystallization and emulsification. Those new in-line instruments measure particle size distribution, morphology and concentration through ultrasonic, optical and tomographic sensing techniques.

According to Dr. Kurt Leschonski of CUTEC in Germany, many of the new instrumentation developments that are making their way into the plants have been available for well over a decade. It's the aggressive drive to run plants more efficiently, combined with the lower cost of computer technologies, that have brought the new tools to the market now.

### Economic impact

An estimated 40%, or more than \$60 billion, of the value added to the chemical industry is reportedly linked to particle technology.

In the early 1990s, Dupont estimated that more than 60% of its 3,000 products were powders, crystalline solids, granules, flakes, dispersions, slurries and pastes; and an additional 18% use particles to impart key end-use properties. Those products span a broad range of industry businesses, such as basic chemicals, agricultural products, pharmaceuticals, paints, pigments, dyestuffs, ceramics and electronic materials.

### A period of neglect

Despite early visionary efforts, most notably by J.M. Dallavalle in his 1943 book on "Micromeritics: The Technology of Fine Particles," the United States has lagged behind in developing particle

technology education. In contrast, Japanese and German universities have developed powder technology departments with strong industrial support.

The tide is turning, however, with formation of the Particle Technology Forum in the United States, a number of centers at key U.S. universities and impressive support from the National Science Foundation.



### Emerging technologies

According to Dr. M.L. Roco, head of the National Science Foundation research program in particle technology and chair of the Emerging Technologies workshop that preceded the World Congress, "Newly understood mechanisms and particulate processes are moving technology to novel concepts for particle use. Recently developed non-intrusive and on-line experimental techniques and parallel processing are changing the methods of investigation and process control from macroscopic to microscopic. Novel synthesis methods of ultrafine particles are pushing new nano- and micro-techniques in particle processing, materials and manufacturing."

### A new horizon in education

A visit earlier this year to the student laboratory of Dr. Y. Tsuji at Osaka University in Japan gave me a glimpse of the new educational tools that will mold the capabilities of future engineers.

Here, it was evident that increased computer power has made discrete particle simulation a practical means for predicting particle motion in a variety of industrial processes. The ability to visualize and simulate those processes provides an extremely powerful tool for product development and equipment design.

The next World Congress of Particle Technology will be held in Australia in the year 2002. Until then, *Chemical Processing* will monitor the marketplace to report on developments and increase coverage of powder and particle technology.

Let us know about your areas of interest and how you're affected.

A handwritten signature in black ink that reads "Peter".

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