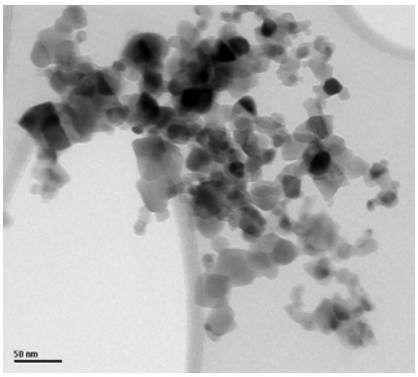
MPLUS+

Real-Time Characterization Project Addresses a Priority Need in Nanomanufacturing

The two main industry groups that provide input to the National Nanotechnology Initiative – the Chemical Industry Vision2020 Technology Partnership (Vision2020) and the Semiconductor Research Corporation (SRC) – recently joined forces to define common, priority R&D needs for accelerating commercialization of nanotechnology.

Mengdawn Cheng of ORNL and Emory Ford of MTI operate a differential mobility analyzer.

A key need identified across industry is the capability for real-time characterization of nanoparticles smaller than 50 nanometers during synthesis processes. According to the industry experts, the techniques currently used either lack the capability to provide accurate measurements, or they are not suitable for in-plant operation. Thus, there is often an inadequate ability to monitor and control production processes for nanoscale materials, resulting in variability in product quality, which hinders progress in research and product development.



Titania nanoparticles produced in experiments. Size bar is 50 nm.

The Industrial Materials of the Future program recognized the emerging needs in nanomanufacturing and initiated a MPLUS project to address this key industrial issue. Emory Ford of Materials Technology Institute (MTI), a major contributor to the Vision2020-SRC efforts, identified the characterization problem, and a multidisciplinary team of R&D experts at Oak Ridge National Laboratory (ORNL) – including chemical engineers, physicists, microscopists, materials scientists, and aerosol scientists – was assembled to demonstrate a promising characterization technique.

The instruments are portable and capable of in-plant operation.

A commercial differential mobility analyzer, which employs the deflection of charged particles in an electric field to segregate particles in a gas stream by electrical mobility size, was used to sample and characterize in real time the nanoparticles produced in two different types of gas-phase processes: a chemical vapor deposition process for production of metal-oxide particles, and a laser-ablation process for synthesis of carbon nanomaterials.

The technique has been shown to be useful for real-time determination of particle-size distributions for sizes much smaller than 50 nm, and it has been demonstrated as useful for detecting small variations of product quality caused by slight changes in process conditions. The promising results of this project have generated several opportunities for continued investigation and process development.

The success of this industry-national laboratory collaborative project to address an urgent, widespread need in nanomanufacturing indicates the value of the MPLUS effort.

U.S. Department of Energy
Energy Efficiency and Renewable Energy

OAK RIDGE National Laboratory