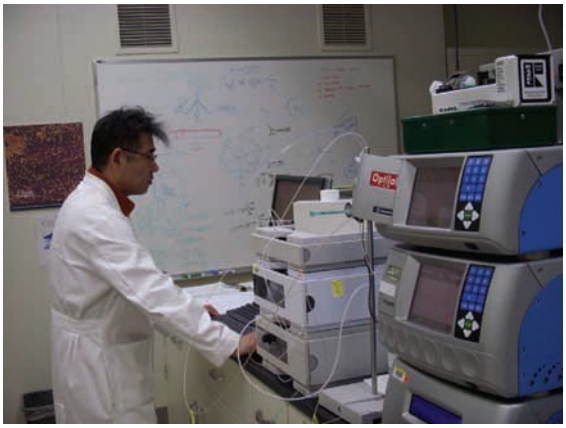
Nanoparticle Measurements and Metrology

FACILITIES

Facilities

In 2007, MSEL researchers established a state-of-the-art facility supporting nanoparticle measurement science and standards that addressed the interdisciplinary needs of cutting edge nanotechnology research. This integrated suite of laboratories and instrumentation is located in Building 223, and includes dedicated space for wet chemistry, sample preparation, instrumentation, and reference material production. Support capabilities include HEPA-filtered clean benches, a sterile class II biosafety cabinet, fume hoods outfitted with HEPA-filters designed to prevent release of aerosolized nanoparticles into the external environment, HEPA-filtered balance enclosure, digital rotary evaporator, ultrasonic disruptors, lyophilizer, centrifuges, and cold storage.



Field Flow Fractionation instrument in nanoparticle lab.

This facility boasts an array of measurement capabilities for characterizing the physical properties of nanoscale to microscale particles, including dynamic light scattering (DLS), electrophoretic light scattering, nanoparticle optical tracking, x-ray centrifugation, laser diffraction spectrometry, UV-Vis-NIR spectrometry, asymmetric-flow field flow fractionation (AFFF) with multi-angle light scattering (MALS), a differential refractometer, and a UV-Vis diode array detector (DAD). Particles ranging in size from less than 1 nm to greater than 100 μm can be sized and fully characterized.

AFFF is a powerful hydrodynamic-based separation method that provides rapid high resolution analysis of nanoparticles and macromolecular species in complex mixtures. Coupling of DLS and MALS in on-line operation yields real-time analysis of size, molecular weight and concentration. The on-line DAD offers the ability to measure full spectral fingerprints of isolated components in conjunction with physical characterization.

Additional capabilities exist for measurement of nanoparticles in concentrated suspensions and gels, including electrokinetic sonic amplitude, acoustic spectrometry and dynamic rheometry. Ancillary equipment, including isothermal and microfluidic flow-cells, have been developed by MSEL researchers for use in conjunction with small-angle x-ray and neutron scattering instruments located at NIST and at off-site facilities. A high vacuum krypton-enabled gas sorption analyzer for determination of BET surface area and porosity is shared with the Building and Fire Research Laboratory at NIST.

Significance

Researchers use this facility to develop measurements, assays, and standards for the physico-chemical characterization of nanoscale particles intended for biomedical and other advanced applications, and to facilitate assessment of the environmental, health, and safety risks associated with engineered nanoparticles. The facility supports research activities involving collaborative efforts with the National Cancer institute, the Food and Drug Administration, the National Institute for Occupational Safety and Health, the Environmental Protection Agency, the Organization for Economic Cooperation and Development (OECD) sponsorship testing programs for engineered nanomaterials, and others.

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