Technology Opportunity

Noncontact Fiber-Optic Particle-Sizing Probe

The National Aeronautics and Space Administration (NASA) seeks to transfer NASA-developed new technology for noncontact particle sizing.

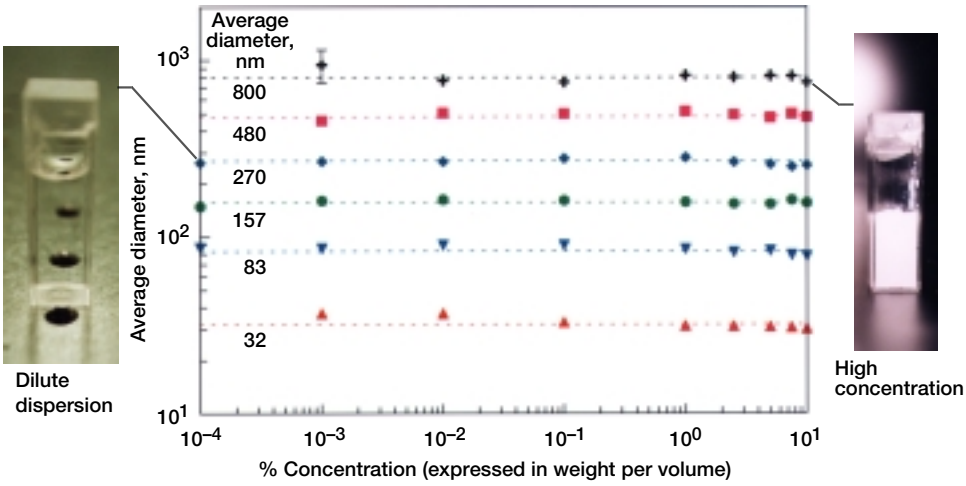
Potential Commercial Uses

- Sizing of submicron particles dispersed in fluid suspensions
- Pharmaceutical applications
- Waste water treatment
- Quality-control operations
- Online monitoring of industrial processes
- Crystallization processes of protein and synthetic materials (zeolite)
- Biomedical applications (early detection of eye diseases, skin and tissue analysis, etc.)

Benefits

- Noncontacting, accurate, and extremely sensitive particle sizing in fluid dispersions and suspensions
- Compact, rugged, and free of optical alignment
- Point and shoot operation—portable and easy to use in various field applications and challenging environments
- Extremely flexible in regards to sample container sizes and shapes
- No external vibration isolation and no index matching required
- Capable of measuring the size of extremely small particles (as small as 1 nm)
- Wide concentration range—very dilute (waterlike) to very turbid (milklike or paintlike) suspensions
- Safe to use—uses very low laser power (10 nW to 3 mW)
- Fast—very short data-acquisition time (5 to 30 sec)
- Adaptable—a video imaging system can be added for viewing particles that are larger than a few microns

Fiber-optic particle-sizing probe.



Particle sizing results on polystyrene dispersions and suspensions.

The Technology

Submicroscopic particles (less than a few microns in size) undergo a random motion called Brownian motion when suspended in liquid. The Brownian motion is caused by constant bombardment of fluid molecules on the particles. When a laser beam is launched into a dispersion, important information, such as the average size of the particles or the size distribution of the particles, can be obtained by analyzing the scattered light for intensity fluctuations caused by Brownian motion. This particle-sizing technique is called dynamic light scattering (DLS) or quasi-elastic light scattering (QELS). DLS/QELS has been widely used in many science applications, and there are several commercially available instruments that measure particle size using DLS/QELS. However, these instruments are rather bulky, prone to optical alignment problems, and cannot be applied to analyze very dilute dispersions and very highly concentrated suspensions. This limits their applications to a well-controlled laboratory environment.

A compact fiber-optic probe (about the size of a dime) was developed for sizing particles in fluid experiments in a microgravity environment (space shuttle, space station, etc.). The probe utilizes fiber optics and integrated optics to be compact, portable, rugged, noninvasive, and easy to use (point and shoot). It also has a very high sensitivity and can reliably and accurately measure a wide range of particle sizes in a wide range of sample concentrations. It can be used with various sizes and shapes of sample containers without any optical alignment problems. In addition, a video imaging system can be incorporated to monitor larger particles (greater than a few micrometers).

The probe has been and is being used successfully in various applications, including protein crystallization, zeolite crystal growth, early diagnosis of various eye diseases, characterization of highly concentrated systems, and the study of food colloids.

Options for Commercialization

A fiber-optic particle sizing probe has been developed at NASA Glenn, and a patent application has been filed. Several companies have shown interest in commercializing this product.

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