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Nanoparticles: shape, size, dispersity, and characteristics

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Summary

Nanoparticles are materials with at least one dimension in the 1 to 100 nm range. Nanoparticles exhibit different physical and chemical properties due to large ratio of surface area to volume and small size effects (or quantum effects). Nanoparticles cover almost all materials including ceramics, metals, and polymers. Nanoparticles have a wide variety of applications in catalysis, electrodes, metallurgy, magnetic storage, composite materials, coatings, MEMS or NMES, cosmetics, etc. Shape, size, and dispersity have influence on the crystal structure and properties of nanoparticles. So shape, size, and dispersity are keys to controlling structure and properties of nanoparticles.

This presentation will focus on the shape, size, dispersity control, and characteristics of some metal and oxide nanoparticles. For the magnetic transition metal and alloy nanoparticles produced at low temperature, where hard agglomeration is not a severe problem, shape and size were adjusted in synthesis. Effects of shape and size on structure and magnetic properties of nanoparticles were investigated. For oxide nanoparticles which have to be heat-treated at high temperature to transform into stable phases, hard agglomeration is a severe problem. Shape of oxide nanoparticles was controlled in synthesis. A novel method has been developed to control dispersity of aluminum oxide nanoparticles. Monodisperse spherical alpha-alumina nanoparticles were prepared and characterized. This novel method may be applied to produce other monodisperse oxide nanoparticles.

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