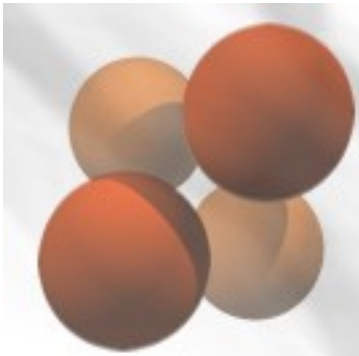

MSE SEMINAR

Materials Science and Engineering
Michigan Technological University

Friday, April 13, 2007
3:00 - 4:00 pm
Room 610, M&M Building

A Theoretical Model for Digestive Ripening

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Abstract

Syntheses of monodisperse nanoparticles have been intensively investigated for opto-electronic or other applications. Recently, gram quantities of monodisperse gold or silver nanoparticles were reported to be produced through a digestive ripening process, in which colloidal particles of size 2 to 40 nm are transformed to nearly monodisperse particles of 4 ~ 5 nm diameter. Digestive ripening, an example for inverse Ostwald ripening, is a puzzling phenomenon since it appears to despise the usual capillary consequence, i.e., reduction of interfacial free energy. We present a theoretical model which accounts for the self-assembled monodisperse state of such nanoparticles by considering the effect of charges on the particles and thus electrostatic energy in their coarsening behavior. An appropriate Gibbs-Thomson equation is first derived, and then particle growth rates are calculated. The results show that success of a monodisperse state depends, among others, on the initial particle distribution, and size distribution at equilibrium follows some of the thermodynamic principles observed in binary phase diagrams.

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