Physics & Astronomy

2009 Spring Colloquium

ATOMIC VIBRATIONS IN METAL NANOSTRUCTURES

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Metallic nanostructures are of great interest in many scientific fields due to their novel size-dependent physical and chemical properties. Intriguing effects such as phonon confinement and phonon localization at interfaces have been observed on low dimensional systems. Such modifications in the vibrational (phonon) density of states of nanoscale materials are of scientific and technological relevance, because they profoundly affect their thermodynamic properties. To study these effects homogeneous and size-selected nanostructures are needed.

We have synthesized size- and shape-selected ^{57}Fe, ^{57}FePt, and ^{57}FeAu nanoclusters with well defined intercluster distances by means of diblock copolymer encapsulation. The size- and composition-dependent vibrational dynamics of these clusters as well as of nanostructured metal multilayers was measured by nuclear resonant inelastic X-ray scattering. An enhancement of the density of low- and high-energy phonon modes as well as non-Debye-like behavior was observed on ^{57}Fe clusters. The latter effects were found to depend on the chemical nature of the surface shell on the nanoclusters. Thickness-dependent phonon confinement effects were detected on nanoscale ^{57}Fe/M multilayers (M = Cu, Pd or Ag). All of these effects show the unique physical properties of metal nanostructures, and their promise in technological applications.

Thursday, 2 April 2009

Refreshments: 3:30 pm, Brace 201

Lecture: 4:00 pm, Brace 211