T_cSAM Bi-Weekly Brown Bag Seminar

Texas Center for Superconductivity and Advanced Materials

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"Raman Spectroscopy of Structural Disorder"

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Room 102, Houston Science Center
12:00 p.m. – 1:00 p.m.

Abstract

Mostly unwanted, the static or dynamical lattice disorder in many cases is either desirable or unavoidable. Static disorder is always present in non-stoichiometric, microtwinned and nano-size materials. Dynamical disorder governs such phenomena as ion diffusion and ion conductivity. It is also substantial for the unusual properties of CMR compounds. Raman spectroscopy is an efficient tool for study of structural disorder, including the dynamical one. This will be demonstrated for three different classes of materials. The doped rare earth manganites $R_{1-x}A_xMnO_3$ (R=rare earth, A=Sr,Ca,Ba,Pb) provide an example of partial disorder due to non-coherent Jahn-Teller distortions of oxygen sublattice. In the insulating paramagnetic or antiferromagnetic phases the Raman spectrum is dominated by broad bands reflecting the partial (oxygen) phonon density-of-states (PDOS). These bands disappear in the metallic ferromagnetic phase, where the Jahn-Teller distortions cannot develop. The second example will illustrate the Raman monitoring of structural disorder in $N_{ax}CoO_2$ crystals. It will be shown that the disorder in this material is surface-dependent and develops with ageing. As a third example, the evolution with temperature of the Raman spectra of nanoporous $Na_2Nb_{2-x}MxO_{6-x}OH_{)x}.H_2O$ will be discussed. Raman spectroscopy in this case allows monitoring of the dehydration above 250C and the transition to a disordered perovskitelike structure above 550C.

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