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Optical Properties of Single-crystalline $Bi_2Sr_2CoO_{6+\delta}$

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The results of the optical reflectivity and Raman-scattering measurements of single-crystalline $Bi_2Sr_2CoO_{6+\delta}$ (δ>0.4) with Neel temperature ~260 K are presented over a temperature range of 20-330 K. At room temperature, the optical conductivity spectrum is typical of an insulator, showing only phonons in the far-infrared, whilethere are three optical absorption bands near 20000, 31000, and 38100 cm^{-1}. Several Raman-allowed phonons have been observed, and their symmetries identified. The temperature dependence of the phononic and electronic excitations will be discussed.

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Iron Oxide Nanoparticles Synthesized by Hydrothermal Process

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The synthesis of iron oxide nanoparticles has been a field intense study due to the novel properties and potentiality on the practical applications to ferrofluids, biomedical applications, such as medical diagnosis with contrast enhancement of magnetic resonance imaging (MRI), magnetic cell separation, and magnetically controlled transport of anti-cancer drugs.

There are several techniques have been used for the synthesis of iron oxide nanoparticles, which including coprecipitation of ferrous (Fe^{2+}) and ferric (Fe^{3+}) ions by a base solution [1], thermal decomposition of iron pentacarbonyl ($Fe(CO)_5$) [2], and organic solution-phase decomposition of the iron precursor at high temperature [3].

The iron oxide nanoparticles, especially magnetite (Fe_3O_4) and maghemite (γ-Fe_2O_3) nanoparticles, were synthesized by hydrothermal synthesis method with $FeSO_4 \cdot 7H_2O$ using basket milling and ultrasonication. To prepare iron oxide nanoparticles, 2.0g of $FeSO_4 \cdot 7H_2O$ dissolved in 150 ml of deionized (DI) water, and 60 mg of KNO3and 0.56 g of NaOH dissolved in 60 ml of DI water. The two solutions were heated to 75°C and mixed the two solutions while stirring which was used a stirring rod not a magnetic bar. The mixed solution was heated to 90°C for 10 minutes while stirring with ultrasonication to prevent agglomeration. The black suspension was cooled to room temperature and added H_2O_2 for oxidation. The sodium hydroxide added to the cooled solution to neutralize and rinsed with DI water. The suspension was dispersed and milled with the basket milling machine. Finally the suspension was rinsed with DI water and dried in a chamber flowing Ar gas. Drying process is very important factor on the iron oxide nanoparticles. The magnetite nanoparticles dried at 80°C for 2 hours, contrary the maghemite nanoparticles dried at 80°C for 30 minutes. To investigate the crystallographic structural properties and magnetic properties of the iron oxide nanoparticles, various analyses were performed including X-ray powder diffraction (XRD), high resolution transmission electron microscopy (HRTEM), scanning electron microscopy (SEM), vibrating sample magnetometer (VSM) and Mössbauer spectroscopy. According to the XRD results, the XRD peaks of the magnetite and maghemite nanoparticles matched well with *JCPDS* standard data, respectively. The particle size of the iron oxide nanoparticles was about 15~20 nm, and particle shape was sphere, which were confirmed by HRTEM image.

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