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Spectroscopic studies of Fe_3O_4 nanocrystals LAYRA REZA, Physics Department, University of Texas at El Paso, FELICIA MANCIU, Physics Department, University of Texas at El Paso, YUDHISTHIRA SAHOO, Institute for Lasers, Photonics and Biophotonics, State University of New York at Buffalo —
We have used IR spectroscopy to study the temperature dependence of optically active phonon modes of Fe_3O_4 nanocrystals, to obtain information about the possible Verwey transition, which is usually manifested in bulk material. The samples were synthesized by colloidal chemistry. The crystallinity and sizes were examined by transmission electron microscopy (TEM) and X-ray diffraction. The TEM pictures show an average size of 6-8 nm for Fe_3O_4 nanocrystals. Samples for the IR studies were prepared in the form of pellets, by embedding them in a polycrystalline CsI matrix. The temperature dependence ($10K < T < 300K$) IR transmission results exhibit a frequency increase upon decreasing the temperature for the infrared-active phonons around 360 cm^{-1} and 574 cm^{-1}, but without notable anomalies around the critical temperature (120K) as compared to those previously observed in a single Fe_3O_4crystal. The appearance of a fine structure at low temperatures could account for the lifting of the degeneracy of the phonon modes. This splitting is associated with the degree of the distortion of the symmetry of the system.

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