Softening of high energy phonons by insulator-superconductor transition in Ba_{1-x}K_{x}BiO_{3} system

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Abstract
Single crystals of Ba_{1-x}K_{x}BiO_{3} compound for 0<x<0.6 from insulator to superconducting region have been grown by electrochemical method. The crystals have been characterized by powder x-ray diffraction and Laue x-ray to determine the crystal structure, formed phases and potassium concentration. Inelastic x-ray scattering spectrum of the crystals has been studied to investigate the phonon properties of this system. The potassium concentration and momentum dependences of the phonon modes have been investigated. The low energy phonons are almost unchanged by increasing of potassium concentration, while the high energy modes are increased considerably by potassium concentration in agreement with Raman and reflection experiments. An anomalous and strong phonon softening has been observed for the high energy phonon modes when the system transitions from insulator to metallic and superconductor system. This anomalous effect suggests a strong electron-phonon interaction and a sign for phonon mechanism of superconductivity in Ba_{1-x}K_{x}BiO_{3} system.

Keywords: superconductivity, insulator-superconductor transition, phonon softening, inelastic x-ray scattering

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