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Ion Channeling study of Jahn-Teller lattice distortions and the phonon properties in magnetic transition element implanted SrTiO₃ Crystals KALYAN SASMAL, D. WIJESUNDERA, Y. HE, B. TILAKARATNE, Q. CHEN, J.H. MILLER, WEI-KAN CHU, Texas Center for Superconductivity & Physics at Univ of Houston — SrTiO₃ is perovskite functional material. STO doped with magnetic transition element (Cr, Fe etc.) is important for electro- and magneto-optical applications. Cr⁴⁺ (d²), Cr⁵⁺(d¹) and Fe⁴⁺ (high-spin d⁴) substituting host Ti⁴⁺ exhibits Jahn-Teller distortion. Rutherford backscattering spectrometry (RBS) in ion channeling orientation is sensitive method for determining structure, position of impurity atom to study defects of crystals and provides direct evidence for JT effect at Cr⁴⁺, Cr⁵⁺ and Fe⁴⁺ centers in STO lattice. Different masses of STO elements helps to investigate such impurities using ICh method by determining distortions of sub lattices without taking into account of small ICh effect from impurities. Axial ion channeling of 2.0 MeV He⁺ ions was applied to study JT lattice distortions of ion implanted STO crystals. Angular ICh spectra of Sr and Ti sub lattices (crystal axes [110] & [100]) were obtained for pure and ion implanted STO crystals. The ratio of minima of ICh yield for Sr and Ti sub lattices was used for quantitative determination of lattice distortions observed in STO: Cr/Fe crystals due to presence of impurities. JT Cr⁴⁺ and Fe⁴⁺ impurity could induce Raman-active localized oxygen vibrational mode, which does not involve motion of nearest Fe or Ti ions.

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