Abstract

Title: PFM and Raman spectroscopy of selected dielectric materials
Author: Fedir Borodavka
Institute: Department of Dielectrics, Institute of Physics of the Academy of Sciences, Na Slovance 2, 182 21, Prague 8, Czech Republic
Supervisor: Ing. Ivan Gregora, CSc.
Training institute: Department of Dielectrics, Institute of Physics of the Academy of Sciences, Na Slovance 2, 182 21, Prague 8, Czech Republic
Consultants: RNDr. Stanislav Kamba, CSc. and RNDr. Vladimír Vorlíček, CSc.

Abstract: The thesis is devoted to a detailed investigation of dielectric materials using Raman spectroscopy and PFM microscopy techniques.

Phonon properties of a newly synthesized guanylurea(1+) hydrogen phosphite single crystals have been studied. A tentative assignment of the observed Raman peaks has been done and the sets of A'_{MIX}, A'_{TO} and A''_{TO} mode frequencies have been determined.

Phonon behaviour of $BiMnO_3$ ceramics, obtained from Raman spectra, has been characterized. After comparing the factor group analysis with the Raman spectra it has been concluded that the material has a centrosymmetric $C2/c$ structure and is not ferroelectric.

Lattice modes of the complex $La_{1/2}Na_{1/2}TiO_3$ single crystal have been investigated. We have numerically analysed the intensity behaviour of the sharp peak at $455\,cm^{-1}$ on heating and suggest that it implies a second-order phase transition and strongly supports the $I4 = mcm$ structure.

A systematic study of the domain structure in $PbTiO_3$ thin films grown on $SmScO_3$ and $TbScO_3$ substrates has been performed using Raman spectroscopy and PFM. It has been shown that $PbTiO_3$ films deposited on $TbScO_3$ have mainly $c/a/c/a$ domain structure, while $PbTiO_3$ films deposited on $SmScO_3$ have $a/a/a/a$ domain patterns. Striking difference between the two domain structures has been attributed to the opposite sign of epitaxial misfit strain at the deposition temperature.

Keywords: Raman spectroscopy, PFM, ferroelectrics, phase transition.