

Statement on Doctoral Thesis of Elizabeth V. John (by her supervisor)

The Ph.D. thesis „Spectroscopic investigation of lattice dynamics of multidomain ferroelectrics“ of Elizabeth V. John is mostly devoted to the manifestations of the ferroelectric domain structure in IR reflectivity spectra of polar phonons, when these spectra are recorded from samples containing more than one ferroelectric domain. The problem is interesting since polar vibrations are expected to reflect not only the volume fraction of the various domain variants present in the sample, but also the geometry and properties of domain walls. Moreover, the subject is becoming important as the enormous progress in material science of ferroelectric ceramics and ferroelectric film allows and requires understanding of finer and finer spectral details. I would like to stress that is obviously a rather difficult and challenging task: the domain wall - phonon interactions are relatively weak, little documented, and depending on a number of hardly accessible parameters. In other words, the fact that some of such effects have been experimentally revealed or even quantified in this thesis work, should be recognized as a significant original contribution, basically opening a new research direction in this subject area.

The submitted thesis manuscript has a rather traditional structure, with three introductory chapters, describing the problematics, basic concepts, and experimental techniques that Elizabeth V. John actively used in her work. The core of the thesis is contained in chapters 4-7. Chapter 4 describes genuine domain-structure effects in case of IR reflectivity of dense PbTiO_3 ceramics; chapters 5 and 6 are devoted to polar phonon modes in multidomain epitaxial thin films of PbTiO_3 and chapter 7 describes successful attempts to probe the phonon response of PZT ceramics subjected to a poling treatment. Main results of chapters 4, 6 and 7 were already published in peer-reviewed scientific journals as scientific papers. Elizabeth V. John made a major contribution in all of them (published papers listed in the thesis under No. 2, 1, and 6, respectively). Finally, the manuscript has also two concluding chapters, devoted to general conclusions and prospects of intermediate future works. The presentation of the ensemble of the thesis suggests that Elizabeth V. John has demonstrated capability to perform independent research work.

Elizabeth V. John has enrolled to the Ph.D. program at MFF UK in October 2007, and since then she has been actively experiencing scientific activities in our Institute. Among others, she has been reading several oral presentations about her work at seminars and international conferences. Due to her experimental skills, friendly character, and diligent working attitudes, Elizabeth V. John has been involved also in a range of other research activities of our Department. Only part of this work was published so far, other studies remain to be prepared for publication, for example Raman scattering studies of CaTiO_3 mineral and of synthetic crystal of quantum paraelectric $\text{LaNaTi}_2\text{O}_6$ or spectroscopic characterization of DyScO_3 substrates.

The thesis is sufficiently well prepared to be examined. I am pleased to recommend that it be approved for award of the Ph.D. degree.

Prague, May 11, 2012-05-13

Ing. Jiří Hlinka, Ph.D.

Dept. of Dielectrics,
Institute of Physics
Academy of Science of the Czech Republic
Na Slovance 2, 18221 PRAGUE 8, CZECH REPUBLIC
Phone: +420-266 052 154 (office)
Fax: +420-286 890 415
E-mail: hlinka@fzu.cz