Pulsed-laser deposition of $LuFeO_3$ – an *in-situ* X-ray diffraction study

V. Holý[1], L. Horák[1], S. Bauer[2], A. Rodrigues[2], B. Nergis[2], T. Baumbach[2]

[1]Department of Condensed Matter Physics, Charles University, Ke Karlovu 5, 121 16 Prague, Czech Republic,
[2]Institute for Photon Science and Synchrotron Radiation, Karlsruhe Institute of Technology, Hermann-von-Helmholtz-Platz 1, D-76344 Eggenstein-Leopoldshafen, Germany

holy@mag.mff.cuni.cz

We investigated the pulsed-laser deposition of epitaxial layers of hexagonal $LuFeO_3$ by measuring the X-ray diffraction intensity in the quasi-forbidden reflection 0003 in situ during deposition. For this purpose, we used a growth chamber attached to the NANO beamline at KARA storage ring of Karlsruhe, Germany.

The dependence of the diffracted intensity exhibited characteristic oscillating behaviour, the period of the oscillation is inversely proportional to the growth rate and the decay of the oscillation visibility relates to the growth kinetics, especially to the transition from two-dimensional to three-dimensional growth mode.

The experimental data were compared to numerical simulations, for which we developed a novel growth model. The model is based on the solution of equations describing the time evolution of monolayer coverages and numbers of mobile particles at surface terraces. From the model it follows that the widths of the monolayer coverage profiles exhibit a power law dependence on the deposition time and the exponent of this law sensitively depends on the width of the diffuse Ehrlich-Schwoebel barrier, as well as on the effective temperature of two-dimensional gas of mobile molecules on the growing surface.

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