Orientation Control of Pulsed Laser Deposited Fluorite-Perovskite Epitaxial Heterostructures

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In the last years there has been an increasing interest in modifying the functional properties of oxide materials by growing epitaxial heterostructures between materials with different cell parameters, even different structure. In this sense the combination of dissimilar fluorite (like Y₂O₃:ZrO₂-YSZ) and perovskite structures (like SrTiO₃-STO) is among the most challenging combinations because of the large mismatch between both equilibrium structures, i.e.: of about 7% for (001)SrTiO₃//(001)YSZ, and [100]SrTiO₃//[110]YSZ. Besides, for complex oxides we have to add the difficulty that surface termination can be of different chemical composition, i.e.: SrO- or TiO₂- termination for equivalent (001)SrTiO₃ planes. In this work we have obtained YSZ and SrTiO₃ heterostructures by PLD, onto (001)-, (110)-oriented STO, and (110)NdGaO₃ substrates. We have studied the film growth and surface crystal structure characteristics by means of in-situ Reflection High Energy Electron Diffraction (RHEED), and correlated to the final surface morphologies obtained by AFM. We have analyzed the crystal structure by X-Ray Diffraction (XRD) and film microstructure by HRTEM. Some of the substrates were submitted to different thermal or chemical treatments in order to study the influence of surface termination in the film growth.

Acknowledgements

The authors would like to thank financial support of Spanish Ministry of Science and Innovation through projects: MAT2008-04931NAN and CSD2008-00023. AC and RB thank “Juan de La Cierva” program for his grant. BB thanks Generalitat de Catalunya and NanoAraCat for financial support for HRTEM analysis.