ICN2

Institut Català de Nanociència i Nanotecnologia

EXCELENCIA SEVERO OCHOA

PhD Thesis Defence

Núria Bagués Salguero

Atomic and electronic structure of self-organized defects in epitaxial films of functional perovskite-type oxides

Directors: **Dr José Santiso López and Dr Felip Sandiumenge Ortíz**

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Abstract

Epitaxial thin films of functional perovskite-type oxides present interfacial coupling and misfit relaxation mechanisms governed by a complex interplay between chemical, electronic and structural degrees of freedom. The relaxation mechanisms of strained films may accommodate defects, such as misfit dislocations or twin walls, which exhibit a strong tendency towards self-organization with characteristic length scales of tens of nanometres. The core lattice structure of these defects is different from the bulk of the material and thus may be considered as a nano-phase with likely different physical properties, leading to the formation of functional nanostructures. The correlation between defect structure and functionality, together with the capacity of these defects to self-organize, offers a unique opportunity for the bottom-up elaboration of functional complex oxides nanodevices.

This thesis focuses on the characterization of the atomic and chemical structure of the interface and self-organized defects of epitaxial films and functional nanostructures of oxide materials by using advanced transmission electron microscopy. The materials studied in this work may be regarded as nanostructured films resulting from the self-organization of misfit relieving defects as follows: nanoinclusions of a MnO_x phase (volume defects) in $LaMnO_3$; twin walls between twin domains (planar defects) in $La_{0.7}Sr_{0.3}MnO_3$ on $SrTiO_3$; and misfit dislocations (line defects) in $La_{0.7}Sr_{0.3}MnO_3$ on $LaAlO_3$. The results and main conclusions obtained in this work open new perspectives for the development of functional self-organized nanostructures based on strain relieving defects.

Institució CERCA Centres de Recerca de Catalunya

BIST Barcelona Institute of Science and Technology

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CSIC Consejo Superior de Investigaciones Científicas

UAB Universitat Autònoma de Barcelona