Research and Teaching Oxide MBE System at JCNS-2 Forschungszentrum Jülich

Connie Bednarski-Meinke1, Patrick Schöffmann1, Annika Stellhorn1, Tanvi Bhatnagar-Schöffmann1, Emmanuel Kentzinger1, Sabine Pütter2, Frank Gossen1, Jörg Perßon1, and Thomas Brückel1

1Jülich Centre for Neutron Science-2/Peter Grünberg Institut-4 (JCNS-2/PGI-4), Germany,
2Jülich Centre for Neutron Science (JCNS) at Heinz Maier-Leibnitz Zentrum (MLZ) Forschungszentrum Jülich GmbH, Germany

The Jülich Centre for Neutron Science develops and uses scattering methods for research into structural and magnetic order of functional materials. The Oxide Molecular Beam Epitaxy (OMBE) laboratory at JCNS-2 provides students and JCNS scientists with a powerful platform to study and realize the growth of thin film magnetic materials. Thin films grown in this system can then be analyzed using the scattering tools available at our institute or further afield at large scale neutron and x-ray synchrotron facilities. Our OMBE has 6 effusion cells and 2 electron guns with 4 sources each for electron beam evaporation, as well as a plasma source for oxide growth. In-situ Reflection High Energy Electron Diffraction (RHEED) is available for surface structure and growth mode analysis. On a vacuum buffer line attached to the main chamber, we also are able to provide Low Energy Electron Diffraction (LEED) surface structure analysis of vacuum annealed substrates and as-grown films, as well as Auger Electron Spectroscopy (AES) for sample chemical analysis. For introduction to thin film growth methods, the OMBE is also used as a teaching tool for the RWTH Aachen as part of the JARA-FIT laboratory course. Students in 2020 had their first encounter with a complex oxide system through a virtual lab course. Doctoral students use the system to grow their own thin films for later analysis with x-ray and neutron facilities and to fundamentally understand the materials growth process. Students at the Forschungszentrum Jülich who use the neutron facilities at MLZ in Garching have the advantage that a sister MBE system is available there for on-site film growth with a vacuum transfer system to a neutron reflectometer (MARIA). Highlights in this poster will include recent projects such as; 73 stoichiometric tuning of strontium cobaltite and a reproducibility study between the two sister MBE's, domain pattern control of iron palladium thin films, and strain and interfaces in lanthanum strontium manganite piezoelectric heterostructures (LSMO/PMN-PT).

Abstract Book "IOP Magnetism 2021", online event, 12 Apr 2021 - 13 Apr 2021, page 72 – 73