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OFLG/402 16:00 – 17:00

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Novel Functionalities in Atomically Controlled Oxide Heterostructures by Pulsed Laser Deposition

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In recent years, it has been shown that novel functionalities can be achieved in oxide heterostructures in which the interfaces are atomically controlled, in terms of atomic stacking as well as in terms of the local symmetry. In this contribution, I will highlight the recent developments in atomic controlled growth of epitaxial oxides by pulsed laser deposition, with a focus on heterostructures showing manipulated magnetic and electronic properties.

Emergent phenomena in oxide heterostructures such as interface charge transfer, two-dimensional electron gas and ferromagnetism between two non-magnetic materials, are induced by the dedicated coupling between spin, orbital, charge and lattice degrees of freedom. Developing strategies to engineer these intimate couplings in oxide heterostructures is crucial to achieve new phenomena and to pave the path towards novel functionalities with atomic scale dimensions. Strong oxygen octahedral coupling has recently been demonstrated, which transfers the octahedral rotation from one oxide into the other at the interface region. As a result, we possess control of the lateral magnetic and electronic anisotropies by atomic scale design of the oxygen octahedral rotation.

Integration of epitaxial complex oxides in Si and III-V technologies has recently attracted a lot of attention in science and industry. Such complex oxides include, amongst others, ferro- and piezo-electrics and materials for resistive switching devices. In this presentation I will focus on the integration of Pb(Zr,Ti)O3 (PZT) with Si and III-V semiconductors. The epitaxial integration of PZT with Si and for instance GaN is hampered by the difference in crystal structure and large lattice mismatch. Using epitaxial buffer layers and optimized growth with pulsed laser deposition, we are able to obtain epitaxial growth of PZT on, for instance, MgO-buffered GaN. The thickness of the MgO can be lowered down to single monolayers while maintaining the high quality and good properties of epitaxial PZT films, which enable practical applications for high power FET's and non-volatile ferroelectric controlled electronics devices.

I will furthermore highlight some recent new insights in the "physics" of pulsed laser deposition of complex oxides, focusing on the influence of oxygen pressure on the deposited species during growth as well as the large-scale growth of epitaxial oxides on wafers up to 200 mm in diameter.