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ABSTRACT

Tuning Structural and Magnetic Properties of Epitaxially Grown thin Film Oxides

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Over the past few decades, the search for faster, more energy-efficient technologies has led researchers to reconsider long-known materials in order to propose innovative mechanisms beyond traditional silicon-based devices. Epitaxially grown thin film oxides stand out due to their exceptional stability and wide range of physical properties, including ferromagnetism, antiferromagnetism, ferroelectricity, and multiferroicity. Their versatility makes them ideal candidates for next-generation electronic devices. However, to fully understand these materials and maximize their potential, it is crucial to establish direct correlations between chemical composition, structural parameters, cation disorder, and physical behavior. Understanding these relationships often requires advanced characterization techniques available at large-scale facilities, where high-resolution probes can reveal intricate details of thin film properties.

Among these techniques, X-ray Magnetic Circular Dichroism (XMCD) is an indispensable tool for investigating the magnetic properties of thin films at the element-specific level. Combine with theoretical simulations, XMCD provides valuable insights into spin and orbital moments, oxidation states, and cation site occupation, enabling a deeper understanding of magnetic behavior in complex oxide systems [1-3]. This study highlights the importance of an accurate description of chemical composition, cation site occupation, and structure to tune functional properties of thin film oxides.

[1] P.V.B Pinho et al., Applied Surface Science 615, 156354, 2023.
[2] G. Krieger et al., Physical Review B 110, 195110, 2024.
[3] C. Blaess et al., Applied Surface Science 690, 162585, 2025.