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Thin Films - Growth, Characterization and Electrochemical Applications


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This book focuses on the growth of nanomaterials as thin films. It covers the recent development of thin films using different techniques, such as electrodeposition. It also discusses the widespread use of electrochemical and magnetic applications. This book brings together multidisciplinary chapters written by leading specialists in the field.

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Unraveling the Extraordinary Anisotropic Magnetoresistance in Antiferromagnetic Perovskite Heterostructures: A Case Study of $\text{CaMnO}_3/\text{CaIrO}_3$ Superlattice

WRITTEN BY

Suman Sardar

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Abstract

Antiferromagnetic (AFM) spintronics offers advantages over ferromagnetic (FM) spintronics, such as zero stray fields, closer packing, and imperviousness to disruptive fields. Anisotropic magnetoresistance (AMR) can be enhanced by materials with pronounced spin-orbit coupling (SOC) and magnetocrystalline anisotropies. AMR research aims to develop new materials and heterostructures with enhanced and tunable anisotropic transport properties for advanced electronic devices. The nonmagnetic ground state of iridium pseudospin moments in SrIrO_3 and CaIrO_3 is determined by SOC and electron correlations (U). This study shows that by coupling CaIrO_3 with a severely distorted canted AFM manganite CaMnO_3 , the AMR can be increased by more than one order of magnitude, primarily due to interlayer coupling. Additionally, the spin-flop transition in a nearly Mott region contributes to an unprecedented AMR of 70%, two orders of magnitude larger than previously achieved. The study demonstrates that thin films of canted AFM phases of CaMnO_3 and CaIrO_3 exhibit dimensionality control, with a diminishing magnetic moment, and the valence state can be altered at interfaces in superlattices involving manganites.

Keywords

- transition metal oxides and heterostructures
- antiferromagnetic spintronics
- anisotropic magnetoresistance
- spin-orbit coupling
- canted antiferromagnet
- spin-flop transition

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