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Octahedral Engineering and Interfacial Structure of Heteroepitaxial Complex Oxides

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Epitaxial strain, utilizing the lattice-mismatch between heterogeneous systems, has been generalized as a standard tool to improve or induce unconventional physical and materials properties, such as ferroelectricity and ferromagnetism. The fact it is so successful that it overwhelmingly enveils another important concomitant parameter, the symmetry-mismatch, that naturally occurs at the interface. The latter can be significant based on early theoretical predications, but direct evidence still lacks due to the challenging needs of 1.) characterization techniques, and 2) an appropriate method to separate it from lattice-mismatch. Here we provide experimental evidence that the symmetry-mismatch strongly impact the magnetic and electronic functionalities of complex oxides using epitaxial Cobaltite and Titanate as examples, e.g. suppressing the TiO6 octahedral tilts in CaTiO3 can drive it into ferroelectric phase and distortion in CoO6 can induce long range ferromagnetic ordering in thin-film LaCoO3, which is paramagnetic in bulk case. It is also suggested that octahedral engineering may work as a useful tool to tune the functionalities in complex oxide heterostructures.

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