Electrochemical stability of (La,Sr)CoO$_3$-$\delta$ in (La,Sr)CoO$_3$-$\delta$/((Ce, Gd)O$_2$-$\delta$ heterostructures

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A modulated coherent (La,Sr)CoO$_3$-$\delta$/((Ce,Gd)O$_2$-$\delta$ heterostructure is characterized for the first time for its electronic and chemical properties. 2D-multilayer architectures are deposited on NdGaO$_3$ (110) single crystal substrate by pulsed laser deposition, resulting in epitaxial structures with in-plane lattice rotation that, via the metal oxides’ interfaces, induces mutual structural rearrangements. Our results show that (La,Sr)CoO$_3$-$\delta$ thin films of 10-100 nm are chemically unstable when exposed to air at 600 °C during electrical cyclic stress-tests. Conversely, improved stability is achieved confining LSC in the nanometric heterostructure. Remarkably, the chemical stabilization occurs without compromising substantially the electrical properties of the LSC component: the heterostructures show unexpected electrical behavior with dominant electronic contributions, fast conductivity and mixed ionic-electronic properties, depending on the number of interfaces and the nano-scaled layers.

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