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Engineering exotic phenomena at oxide interfaces[1]

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Complex transition metal oxides form an important class of compounds, exhibiting a wide variety of functional properties exploited in many applications. Thanks to advances in deposition techniques, these oxides can also nowadays be combined in heterostructures, with a structural quality comparable to what is achieved for conventional semiconductors, and the appearance of new phenomena at the interfaces where oxides with different properties meet brought recently the field to an entirely new level. Such phenomena include, for instance, the appearance of a two- dimensional electron gas at the interface between insulator oxides, the possibility of unexpected coupling between structural instabilities at some interfaces yielding unusual functional properties or the tunneling through ferroelectric and multiferroic barriers. Concentrating on few selected examples, I will illustrate how first-principles calculations can efficiently help the experimentalists to characterize the interfaces between complex transition metal oxides and sometimes guide them toward the design of new interesting heterostructures with exotic properties.

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