Polarity effects in free, metal- and oxide-supported nano-objects

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Abstract

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Extended polar objects present an electrostatic instability which induces substantial modifications of the surface charge density. Microscopic surface processes related to polarity compensation have been extensively studied in the last decades, also as a potential tool for tuning surface electronic and structural properties [1]. **More recently it has become clear that polarity does also concern nano-objects, but that the relevant electrostatic forces and the response they induce may differ from the known ones [2].** Indeed, below a critical size, nano-objects may sustain finite dipole moments which drive strongly size- and dimensionality- dependent properties [3]. At small sizes, polarity effects may also extend beyond the surface region and drive structural transformations of the entire object, resulting in novel structures, with no bulk counterparts [4]. Since oxide nano-objects, such as ultra-thin films and nano-islands, are often synthesized on metal substrates, their polarity characteristics are additionally modified by the electrostatic coupling between their structure and the interface charge transfer [5].

We will illustrate the above concepts with our recent results on MgO ultra-thin films and stress the analogy with scenarios taking place at polar oxide interfaces.

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