Thermodynamic processes and their implications for low temperature transport at complex oxide interfaces and surfaces

Low-dimensional electron transport observed along complex oxide heterointerfaces has attracted enormous attention in recent years. While the formation of these 2-dimensional electron gases is generally attributed to electronic charge transfer triggered by a built-in electric field, the ionic defect structure at these interfaces is still being discussed controversially.

Here, we address the thermodynamic processes associated with built-in electric fields and derive ionic defect concentration profiles established at polar/non-polar oxide interfaces. [1] As we discuss, the specific ionic-electronic defect structure stabilized within such interfacial space charge layers strongly depends on ambient oxygen partial pressure applied during sample fabrication and on the strength of the built-in electric field.

As we ground states obtained for various oxide heterostructure systems [2] and discuss resulting implications for important measures characterizing the electron gas, such as electron mobility [3] as well as its magnetic signature [4], both controllable by thermodynamic means. The thermodynamic model obtained for oxide heterointerfaces is furthermore linked to kinetic space charge formation occurring at complex oxide surfaces [5, 6].

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