

Van der Waals Oxide Heteroepitaxy for Transparent and Flexible Electronics

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Abstract

In the diligent pursuit of low-power consumption, multifunctional, and environmentally friendly electronics, more sophisticated requirements on functional materials are on demand. For example, flexible electronics represents a fast-developing field and has a great potential to impact our daily life. In building up flexible electronics, the materials with controllable conduction, transparency, and good flexibility are required. Recently, the discovery of free-standing 2D materials has created a revolution to this field. Pioneered by graphene, these new 2D materials exhibit abundant unusual physical phenomena that is undiscovered in bulk forms. In the meantime, it also possesses very high transparency to the visible light. However, the extensively studied pristine graphene naturally has no bandgap and become restricted in many field-effect based applications. Hence, looking for various types of new 2D materials has been a focal research direction nowadays. In this talk, we intend to take the same concept, but to integrate a family of functional materials in order to open new avenue to flexible electronics. Due to the interplay of lattice, charge, orbital, and spin degrees of freedom, correlated electrons in oxides generate a rich spectrum of competing phases and physical properties. However, a generic approach to build up flexible electronics based on functional oxides is yet to be developed. In this study, we use a 2D material as the substrate. And we take several functional oxides as model systems, including transparent conducting oxides, VO_2 , NiO , Fe_3O_4 , $\text{Pb}(\text{Zr,Ti})\text{O}_3$, and oxide nanocomposites, to demonstrate a pathway to build up functional oxides for transparent and flexible electronics.

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