## Trans-Dimensional Materials Created by 2D Oxides

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Hierarchical self-assembly is a ubiquitous process in nature where it underlies the formation of complex biological structures. Over the past decades, scientists have aspired to exploit modular approaches to create new artificial materials with hierarchical structures and tailored properties. However, *de-novo* design of such hierarchical structured materials is still a major challenge. In this talk, we present new design principles for tans-dimensional materials using hierarchically structured assembly of 2D oxide nanosheets.

As a new direction for the hierarchical self-assembly, dimension-reduced approaches such as layering 2D nanostructures become an important target. Among various 2D nanosheets, 2D oxide nanosheets are important, fascinating research targets to be pursued because of the virtually infinite varieties of layered oxide materials with interesting functional properties<sup>1,2)</sup>. Oxide nanosheets have distinct differences and advantages compared with graphene and other 2D nanosheets because of their potential to be used as insulators, semiconductors, and even conductors, depending on their chemical composition and the structures of the parent layered compounds. Oxide nanosheets also have remarkable potential as building blocks for tailoring tans-dimensional materials combined with a wide range of foreign materials such as organic molecules, gels, polymers, and inorganic nanoparticles. In practice, colloidal nanosheets can be organized into various nanostructures or combined with a range of foreign materials at the nanometer scale by applying solution-based self-assembly<sup>3,4)</sup>. Such soft-chemical protocols relying on 2D building blocks open up pathways to create new artificial materials with kinetically controlled, hierarchical nanoarchitectures and tailored properties. We present a perspective on the advantages offered by nanosheet architectures for various applications in optoelectronics<sup>5-7</sup>, spinelectronics<sup>8</sup>, energy and environment technologies<sup>8,9)</sup>.

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