IBS CINAP Seminar

Sept. 5th, Thurs. 2019, 4:00PM

Room 86126 (N Center), Sungkyunkwan University

Strain engineering multi-functionality in Perovskite oxides for applications in Energy and electronics

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Abstract

Multifunctional oxides materials, primarily ABO_3 transition metal perovskite oxides (A: Ca, Sr, Ba, Bi and rare earth, B: transition metal), have designable and tunable 'knobs' to adjust multi-functionalities (di-, ferro- and piezoelectric, ferro- and antiferro- magnetic, insulating, metallic, half-metallic, superconducting as well as catalytic properties). The ABO_3 possess such a fundamental and functional unit, BO_6 octahedra with central B-site transition metal cations coordinated by six oxygen ligands. Variations of the functional BO_6 in size, shape (bonding length, number of unequal bonds) and connectivity (the magnitude/pattern of octahedral rotations) access to a wide spectrum of multi-functionalities, enabled by the strong coupling among the lattice, charge, spin, and orbital degrees of freedom.

ABO_3 are highly sought after in modern electronics such as low-power and non-volatile ferroelectric or magnetic random access memories (FERAMs or MRAMs), tunable multifunctional spintronic devices including four-state memory, for low-power refrigeration, energy-efficient harvesting devices and energy generation/storage. Many oxide heterostructures, primarily planar structures have been studied for devices.

Herein, I introduce two different approaches to tune/enhance the multi-functionality of ABO_3 in the view point of structural distortion (i.e. strain engineering): 1) Self-assembled nanocomposite. 2) Combining (iso-) 3D-chemical and 2D-biaxial pressure. I will present several successful examples of strain engineering in perovskite oxides.

Besides, I will discuss other effects such as charge leakage/transfer on tuning multi-functionality in heterostructures.

Brief Bio

I earned my PhD at POSTECH, South Korea in 2007. In my thesis work, my topic was the fabrication of superconducting MgB_2 thin films and study of vortex avalanches of MgB_2.

Since 2009, I was working at Device Materials Group of Dep. of Material Science and Metallurgy at University of Cambridge during last around 9 years as a visiting researcher and PDRA. I have focused on Designing/Nanoengineering oxide thin film and understanding various properties to create improved energy efficient ICT devices and high performance energy storage devices. My main research aim is to tune the multi-functionalities of ABO_3 perovskite oxide which is highly sought after in modern electronics such as low-power and non-volatile ferroelectric or magnetic random access memories (FERAMs or MRAMs), tuneable multifunctional spintronic devices including four-state memory, for low-power refrigeration and in energy-efficient harvesting devices.

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