

Scanning probe microscopy studies in functional oxide films: from ferroelectricity to oxygen ion transport

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For the past three decades, scanning probe microscopy (SPM) has emerged as one of the most powerful tool to probe various physical phenomena in materials on the nanometer level. Using the nano-sized sharp tip, we can obtain topographic images of the material surface. In addition, we can measure local force change, local current, and local mechanical displacement depending on the stimulus that we applied via the tip. In this colloquium, I will present my SPM research results in functional oxide films, such as ferroelectric films and oxygen electrolyte films. First, I will briefly introduce the principles of several SPM modes, including piezoresponse force microscopy (PFM) and conductive-atomic force microscopy (c-AFM). Then, I will talk about PFM studies to study nanoscale domain switching dynamics in ferroelectric thin films. Finally, I will present c-AFM studies to investigate the origin of enhanced oxygen ion conductivity in vertically aligned oxide heterostructures.