Probing Genuine Piezoresponse in Piezoresponse Force Microscopy

Yunseok Kim[1, *]
[1]School of Advanced Materials Science and Engineering, Sungkyunkwan University (SKKU), Suwon 16419, Republic of Korea
*Yunseok Kim: yunseokkim@skku.edu

Piezoresponse force microscopy (PFM) has been used extensively for exploring nanoscale piezo/piezoelectric phenomena over the past two decades. The imaging mechanism of PFM is based on the detection of the electromechanical (EM) response induced by the inverse piezoelectric effect through the cantilever dynamics of an atomic force microscopy. However, several non-piezoelectric effects can induce additional contributions to the EM response, which often lead to a misinterpretation of the measured PFM response. For examples, several research groups reported non-piezoelectric electromechanical effects such as electrostatic interaction and instrumental background signal. More recently, ferroelectric-like hysteresis loops were reported in non-ferroelectric materials, such as TiO_2, NiO and Li ion conductors. In this presentation, I will summarize our recent efforts to explore the non-piezoelectric origins of the EM response that impair the interpretation of PFM measurements. For instance, electrostatic interaction, electrochemical strain, and the other contributions will be discussed in various material systems such as conventional ferroelectrics ($Pb(Zr,Ti)O_3$), a newly reported ferroelectrics ($CH_3NH_3PbI_3$) and mixed ionic and electronic conductors (TiO_2). Further, I will discuss differentiation of piezo/ferroelectric effects using PFM to probe genuine piezoresponse in PFM.