NEBRASKA CENTER FOR ENERGY SCIENCES RESEARCH

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Enhancement of Pyroelectric Effect on Organic-Inorganic Interfaces

Abstract.

The proposed project centers on basic research of the surface pyroelectric effect in archetype pyroelectric materials barium titanate and lithium niobate. The ***goals*** are to understand fundamentally the factors that contribute to the surface pyroelectric effect and to improve it by engineering the surface of ultrathin films with strongly dipolar organic adsorbates that amplify the temperature-dependence of the surface polarization. Molecular adsorption on functional oxides is an emerging field, but for there to be major improvements in pyroelectric sensors and energy converters, there has to be a combination of clever chemistry, comprehensive interface characterization and prototype device testing, which is proposed here. The project team will enhance pyroelectric constants by exploiting a so far largely ignored surface pyroelectric effect, which can be very large and even dominate the pyroelectric behavior of ultrathin films and nanostructures. A unique combination of scanning tunneling microscopy and spectroscopy, piezo response force microscopy and photoemission/inverse photoemission will be applied to ultrathin oxide films under ultrahigh vacuum conditions to determine the atomic basis of structure-properties relationship of pyroelectrics, and to establish conditions for maximum pyroelectric effect. This project is expected to accelerate a current trend in increasing the pyroelectric power output through nanomaterials design and will be the first study that seeks to improve the pyroelectric coefficients through interface engineering. The ***impact*** can potentially be huge: the increased energy conversion efficiency will permit various applications, from low-power on-chip energy sources to improved sensors for infrared radiation.