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Applications of Domain Engineered Templates Using Pyroelectric and Photogalvanic Effects

Lithium niobate ($LiNbO_3$:LN) is a typical ferroelectric material possessing excellent piezoelectric, pyroelectric, optoelectric, photovoltaic and non-linear optical properties. As a nature of ferroelectric material, such effects depend on the direction of spontaneous polarization. When anti-parallel domains are created in a single crystal by locally inverting polarization, the patterned domain structures enable various new applications to be developed. Recently, such patterned polar surfaces in micro- to nano-scale ranges with precise control and rational design can be fabricated in defect- controlled stoichiometric LN single crystal.[1] Direction of spontaneous polarization has a strong effect on reactivity of surfaces. For example, when the ferroelectric surface is touched to a solution containing metal ions and exposed to super band gap irradiation, metal cations react with the photo-excited electrons that are transferred by the photo-galvanic effect to the positive domain surface and become reduced to metallic nanoparticles. Size and shape of metallic (for example, Ag and Au) nanoparticles can be well controlled by UV irradiation time, concentration of metal containing acid solution. These metallic nanoparticles can be used for specific adsorption of charged ions, molecules (including designed DNA) and particles in nano-scale size. Such self-assembled functional nanoparticles on the patterned domain surfaces lead to new applications of molecule manipulation, such as molecule immobilization, molecule identification, and molecule "catch and release". I summarize here new applications of nanoparticles for molecule manipulations on domain engineered LN templates

Wednesday, May 16
4:00 pm
136 Jorgensen Hall

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