

Engineering Ferroelectric Domain for Nonlinear Photonics

S.N.Zhu

National Laboratory of Solid State Microstructures & Physics Department
Nanjing University, Nanjing, 210093, China

For the recent two decades, spurred by the success of the semiconductor superlattice and quasi-phase-matching(QPM) technique, engineering domain has become a hot topic in material science and photoelectronics. The domain-engineered ferroelectric crystal is a single crystal in which the ferroelectric domain is modulated artificially according to some sequence, forming so-called superlattice structure. The physical properties associated with third-rank tensors like nonlinear susceptibility tensor $\chi^{(2)}$ in such a crystal are modulated with domains, whereas those associated with even-rank tensors remain constants. This makes the crystal different from a homogeneous single domain one, and specially favorable for applications in nonlinear photonics. In the case that the wavelength of light wave is comparable with or smaller than the size of domain, that is, the reciprocal vector of the modulated structure is comparable or larger than the wave vector of light wave, many fancy physical effects may create through the interaction of the wave vectors and the reciprocal vectors of superlattice. For example, the enhancement of optical frequency conversion, the amplification of light scattering signal, the generation of entangled photon pair and polariton excitation *etc.* The interests in engineering domain structure of ferroelectric crystal lie not only in its fundamental research but also in practical applications. Many of them have been put to use in novel devices matched with contemporary nonlinear photonics.