

Electrocaloric Effect in Ferroelectric Thin Film

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Electrocaloric(EC) effect which is the change of temperature under the adiabatic condition in response to the applied electric field receives extensively research because it can be used as the solid state refrigeration with the feature of environmentally friendly and high efficiency. In this work, the EC effect in the ferroelectric thin film has been studied. Theoretically, the influence of the domain structure, crystal orientation and misfit strain on the EC effect in ferroelectric thin film has been studied by using the phase field method combine with thermodynamics analysis. The results shows that the domain structure has large influence on the magnitude of adiabatic temperature change. A negative EC effect has been predicted in ferroelectric thin film with 180° domain structure. The EC effect in polycrystal thin film with preferred grain orientations is larger than that with the with random grain orientations. Experimentally, ferroelectric thin films have been prepared and the adiabatic temperature change has been studied. The negative EC effect of PbZrO₃ anti-ferroelectric thin films with different preparation process were explored. The negative EC effect of multilayered ferroelectric thin films with staggered structure and sandwich structure were studied, respectively. In addition, it has been proved that phase transition can enhance the room temperature EC effect of BaTiO₃ thin film.