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BaTi03单晶的正方形电畴翻转模型

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A SQUARE DOMAIN SWITCHING MODEL FOR BaTiO3 SINGLE CRYSTAL

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摘要 大量实验已经证实电畴翻转是铁电材料非线性和迟滞性本构行为的根本原因。研究者已经对BaTiO3单晶的微观电畴翻转行为进行了详细的研究，给出了电畴纵向长大和横向扩张的速度公式。依据这些关系，结合电畴翻转是一渐变过程提出了正方形电畴翻转模型，目的是为了从微观上建立电畴翻转体积分数的演化方程。进一步，应用模型对轴向应力和轴向电场作用下铁电陶瓷的本构行为进行了研究。理论结果与实验数据的比较表明，模型能较好地描述铁电材料的非线性本构行为。

关键词： 单晶 电畴翻转 电畴翻转体积分数 正方形电畴翻转模型 非线性本构

Abstract： It is proved by lots of experiments that, domain switching is the main reason for the nonlinear and hysteresis constitutive behaviors of ferroelectric ceramics. And a large number of studies have been conducted on the microscopic domain switching behaviors of BaTiO3 single crystals. Through direct stroboscopic observation, the forward and sideway motion of 180º domain wall is measured, and the formula of velocity is given. In order to derive the evolution equation of the volume fraction of domain switching, a square domain switching model is developed according to the relation between the domain wall velocity and applied electric field. The proposed model is compared with the nonlinear behavior of BaTiO3 single crystals subjected to mechanical loadings and electric field loadings. It demonstrates that the model presented can predict the typical nonlinear the nonlinear hysteresis of ferroelectrics under electrical or mechanical loading.

Key words： single crystal domain switching the volume fraction of domain switching square domain switching model nonlinear constitutive

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