

Studi simulasi kurva histeresis bahan Ferroelektrik berbasis teori dinding domain menggunakan model Langevin dan Ising Spin =
Simulation study of hysteresis curve for Ferroelectric materials based on domain wall theory by using Langevin and Ising Spin model / Hamid

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Abstrak

ABSTRAK

Tesis ini membicarakan model histeresis bahan ferroelektrik dengan meninjau teori dinding domain. Model dibuat melalui dua tahap. Pada tahap pertama membuat relasi anhisteresis Langevin dan Ising spin dengan memasukkan interaksi antar dipol. Pada tahap kedua histeresis ditinjau dengan teori dinding domain. Kurva model divalidasi dengan kurva eksperimen bahan PMN-PT-BT [Pb(Mg,Nb)O₃-PbTiO₃-BaTiO₃]. Diperoleh koefisien Pearson kurva model terhadap kurva eksperimen sebesar 0.9988. Dengan demikian kurva histeresis hasil simulasi adalah valid. Studi kurva histeresis bahan ferroelektrik PZT4, PZT5A, PZT5H, PMNT [Pb(Mg,Nb)TiO₃] kristal tunggal, BZT [Ba(Zr,Ti)O₃], bahan BT-BZ (BaTiO₃-BaZrO₃) film tipis dan PZT [Pb(Zr,Ti)O₃] film tipis memperoleh harga koefisien Pearson r² lebih besar dari 0.97 untuk model Langevin maupun Ising spin. Hal ini menunjukkan model Langevin maupun Ising spin baik digunakan untuk studi kurva histeresis berbagai bahan ferroelektrik. Bahan PZ26 (PbZrO₃) kurang baik menggunakan model berbasis dinding domain, karena kurvanya tidak simetri.

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ABSTRACT

This thesis addresses the modeling of hysteresis in ferroelectric materials through consideration of domain wall theory. The model is developed in two steps. In the first step, anhysteresis relation of Langevin and Ising spin is obtained with dipol interaction. In the second step, hysteresis is incorporated through consideration of domain wall theory. Curve model is validated through curve experiment PMN-PT-BT [Pb(Mg,Nb)O₃-PbTiO₃-BaTiO₃] material. Pearson coefficient for curve model is more than 0.99. So curve model is valid. Curve hysteresis ferroelectric studies of PZT4, PZT5A, PZT5H, PMNT [Pb(Mg,Nb)TiO₃] single crystal, BZT [Ba(Zr,Ti)O₃], BT-BZ (BaTiO₃-BaZrO₃) thin film and PZT [Pb(Zr,Ti)O₃] thin film materials yields Pearson coefficient more than 0.97 for Langevin and Ising spin model. It shows that Langevin or Ising spin model is good for studying hysteresis curve of ferroelectric materials. PZ26 (PbZrO₃) material is not appropriate with model based on domain wall theory, because of asymetri curve.