Ferroelectric Homogenized Energy Polarization Model

http://www.leapcad.com/Ferroelectrics/Polarization_Homogenized_Energy.mcd

Model: Professor Ralph C. Smith, NC State University

Polarization_Model_DemoMC

VXPhysics.com

Model Type, Assumptions, and Data:

Discretized Macroscopic Model with 4-point Gauss-Legendre Quadrature Rule
Lognormal/Normal Density(2), No Thermal Relaxation(0)

dat := READPRN("http://www.leapcad.com/Ferroelectrics/params_pzt_log_demo.dat")

$C := dat_2$ $E_{c\_bar} := dat_3$ $c := dat_4$ $c_1 := \sqrt{C}$ $b_2 := dat_5$ $E_{c\_int} := E_{c\_bar} \cdot 200^{c}$ $E_{i\_int} := \sqrt{b_2 \cdot 7}$

$C = 1.417 \times 10^{-12}$ $E_{c\_bar} = 7.581 \times 10^{5}$ $c = 0.239$ $c_1 = 1.191 \times 10^{-6}$ $b_2 = 2.985 \times 10^{10}$

$E_{c\_int} = 2.696 \times 10^{6}$ $E_{i\_int} = 4.571 \times 10^{5}$ $\mu := 10^{-6}$ $\varepsilon_0 := 8.854 \cdot 10^{-12} \cdot \frac{F}{m}$ $M := 10^{6}$

Model Solution Results Output to "PolarOutput File"

PFile := READPRN("http://www.leapcad.com/Ferroelectrics/PolarOutput2.txt")

$E := submatrix(PFile, 1, 1461, 1, 1) \cdot 10^{-6}$

$P := submatrix(PFile, 1462, 2922, 1, 1) \cdot 100$

Cohercive and Interactive Fields: Ec and Ei

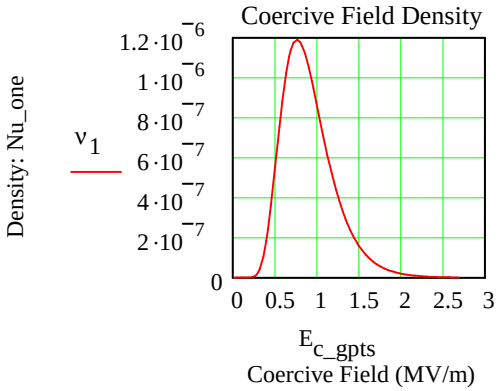
$E_{c\_gpts} := submatrix(PFile, 2923, 3002, 1, 1) \cdot 10^{-6}$

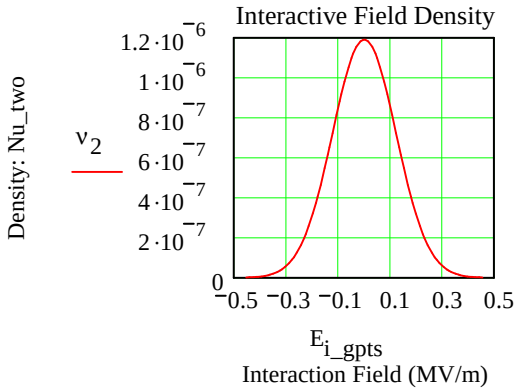
$E_{i\_gpts} := submatrix(PFile, 3164, 3243, 1, 1) \cdot 10^{-6}$

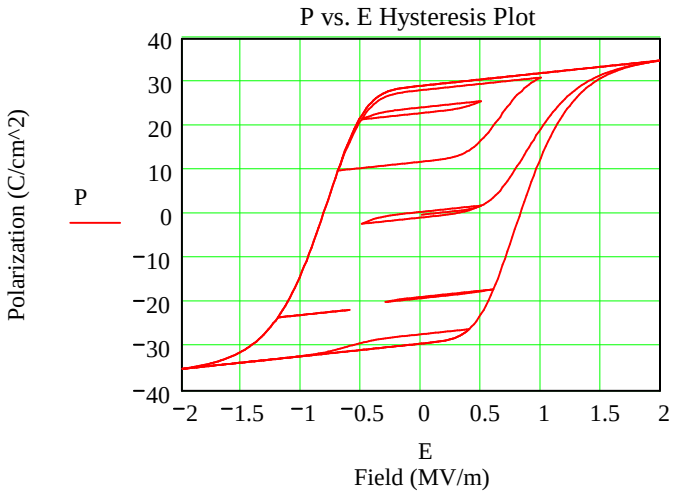
Density Calculations: ν1 and ν2

$\nu_1 := submatrix(PFile, 3003, 3082, 1, 1)$

$\nu_2 := submatrix(PFile, 3084, 3163, 1, 1)$







$R := \text{rows}(E) \qquad n := 1 .. R - 2 \qquad u := 1031 .. 931$

$$k_n := \frac{1}{\varepsilon_0} \cdot \left(\frac{P_{n+1} - P_n}{E_{n+1} - E_n} \right) \cdot \frac{\mu \cdot \text{coul}}{\text{cm}^2} \cdot \frac{m}{M \cdot V} \qquad \kappa_u := k_u$$