Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Enhancement of Magnetoelectric Effect in Ferromagnetic-Piezoelectric Nanostructures at Electromechanical Resonance[1] A.V. KOZIN, M.I. BICHURIN, YU.J. PUKINSKY, V.M. PETROV, Novgorod State Univ. Russia, G. SRINIVASAN, Oakland Univ., MI — A theoretical model is presented for giant magnetoelectric (ME) coupling in nanobilayers, nanopillars and nanowires of ferrite and piezoelectrics on MgO substrates or templates in the electromechanical resonance region (EMR). We take into account clamping effect of the substrate in determining the ME voltage coefficient. ME coefficients are obtained from known material parameters (piezoelectric modules, magnetostriction, stiffness, geometrics) using the solution of the elastodynamic and electrostatic equations. With increasing substrate thickness the theory predicts a shift in the resonance frequency along with a decrease in the ME interaction due to the clamping effect. The strongest interactions are expected for ferrite nanopillars in a piezoelectric matrix when the pillar height is large compared to substrate thickness. As an example, the ME voltage coefficients are estimated for nanostructures based on nickel and cobalt ferrites and piezoelectric PZT and PMN-PT. Although the estimates here are based on bulk material parameters, it can easily be refined to take into account parameters for nanosized components.

[1]Supported by grants from NSF, Russian Foundation for Basic Research and Russian Ministry of Education and Science.

G. Srinivasan
Oakland Univ.

Date submitted: 19 Nov 2007 Electronic form version 1.4