Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Magnetostriction of Fe-based alloy[1] YANNING ZHANG, JUEXIAN CAO, RUQIAN WU, Department of Physics and Astronomy, University of California, Irvine, California, 92697 USA — High magnetostrictive materials are important for sensor and actuator applications. Although the rare earth-3d metal compound, such like TbFe2, have large positive magnetostriction of ∼2600ppm, their practical application was hindered due to larger activation external magnetic field and their high material costs. Large-scale industrial applications require soft magnetic materials with high magnetostrictive materials with low material costs. Nanocrystalline Fe-based alloys without rareearths are very interesting candidates due to the fact doping some nonmagnetic element, such as Ga, Al, Zn and Be, strongly alters the anisotropy energy and enhances the magneticostiction, which indicated substituting Fe by nonmagnetic elements might be a new method to develop cheap and soft magnetic material with high magnetostriction. With First-principle calculations, we have investigated the Young's modulus, shear modulus, anisotropy energy and magnetostriction of Ga, Al, Zn, Ge and Be doped in bulk Fe. The magneto-crystalline anisotropy energy E_{MCA} and the magnetostrictive coefficients (λ_{001}) strongly depend on the compositions and atomic arrangement. A rigid band picture is proposed to estimate the trend of magnetostrictive coefficients of Fe, Ga and Zn compounds.

[1]Work is supported by US DOE (Grant No. DEFG02-05ER46237).

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Date submitted: 17 Dec 2008 Electronic form version 1.4