Abstract Submitted
for the APR05 Meeting of
The American Physical Society

Modeling of Magnetostriction in Particulate Composite Materials ZHOU YAN, F.G. SHIN — The objective of the present work is to develop a conceptually simple and convenient approach to magnetostriction for particulate composites of magnetostrictive polycrystalline inclusions in elastically isotropic matrices applicable to the whole range of volume fraction of the inclusions, since these composites are often fabricated with a high content of magnetostrictive particles. For illustrative purposes, the calculation for the magnetostriction of composites containing Terfenol-D or Nickel are presented. Beginning with the basic elasticity and magnetostriction equations, we use a self-consistent model to calculate the effective elastic and magnetostrictive behaviors of Nickel/epoxy and Terfenol-D/glass composites. The longitudinal magnetostriction of pure polycrystalline Terfenol-D is deduced from the experimental data of the composite having 60% volume fraction of Terfenol-D; Nickel data is taken from literature. Through numerical calculation, we have obtained the macroscopic longitudinal strains parallel to the applied magnetic field for Terfenol-D/glass composites and both longitudinal and transverse strains for the Nickel/epoxy composites. Goodness of fit for both material systems shows our model is applicable up to very high volume fraction of inclusions. Our magnetostriction model can be useful in providing a general guide for the evaluation and technical improvement of magnetostrictive composites currently under development.

Zhou Yan

Date submitted: 16 Nov 2004 Electronic form version 1.4