Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Crystallization behavior of mechanically milled nanocomposite Pr-Fe-B alloys[1] GEORGE HADJIPANAYIS, MELANIA MARINESCU, YONG ZHANG, ALEXANDER GABAY, Department of Physics, University of Delaware, Newark, DE 19716 — In the past few years, research studies have proposed the high energy mechanical milling as an alternative route to the melt spinning for the development of nanocomposite two-phase 2:14:1 / bcc Fe magnets. The current work presents our results on $Pr_9Fe_{85}B_6$ and $Pr_9Dy_1Fe_{76}Co_8Si_1B_5$ mechanically milled powders with emphasis on the microstructure peculiarities, phase transformations upon annealing and their relation with the magnetic properties. Calorimetric investigations in as-milled powders show a main exothermic peak occurring at relatively low temperatures (350°C) that has been associated with a stress-relief effect. HRTEM micrographs for as-milled powders give evidence of coexistence of bcc Fe or (Fe,Co) phase ($d_g \cong$10-15 nm), and an amorphous phase. The amorphous phase is still observed in powders annealed at 400°C and coexists with slightly enlarged bcc Fe or (Fe,Co) grains ($d_g \cong$15-20 nm) and with a newly precipitated 1:7-type phase. A high degree of strain is present in the nanograins. The microstructure becomes free of internal stresses and completely crystallizes at 650°C. The extrinsic magnetic properties are strongly related to the powder microstructure.

[1]Work supported by US Dept. of Energy (DoE).

George Hadjipanayis
Department of Physics, University of Delaware, Newark, DE 19716

Date submitted: 06 Dec 2004 Electronic form version 1.4