Abstract Submitted
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Dependence of grain size and defect density on the magnetic properties of mechanically alloyed Fe90W10 powder[1] DHANANJAY KUMAR, NANA KWAME YAMOAH, North Carolina A T State University, M.A. KOTEN, J.E. SHIELD, University of Nebraska-Lincoln, J NARAYAN, North Carolina State University, UNL COLLABORATION, NCAT COLLABORATION — Mechanical alloying was used to synthesize nanocrystalline $Fe_{90}W_{10}$ powders from high purity Fe and W powders. The Scherer-Debye and Williamson–Hall equations revealed that grain size reduction and defect creation were achieved during the milling process. There is a decrease of grain size from about 53 nm to about 6 nm after 80 h of milling. Williamson and Smallman's equation was also used to calculate the dislocation density. The result shows an increase in the dislocation density with increasing milling time. The grain size and defect characteristics were correlated with magnetic measurements. As W is continually dissolved in the Fe lattice, the change in coercivity seems to be minimal until the completion of solid solution when there is a sudden increase in coercivity. The increase in coercivity is explained by an increase in anisotropy due to an additional source of anisotropy arising from strain during the milling process. There was also a decrease in saturation magnetization as a result of the grain size reduction.

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