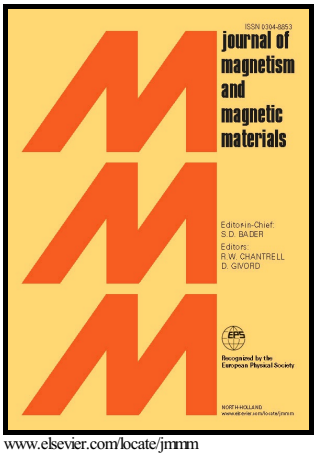

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Tuning the microstructure and magnetic properties of bulk nanocomposite magnets with large strain deformation

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Abstract

In this study, we investigated the effect of strain on the microstructure and magnetic properties of bulk α-Fe/$Nd_2Fe_{14}B$ nanocomposite magnets produced by a combination of severe plastic deformation at room temperature and subsequent thermal annealing. Experiment results indicate that severe plastic deformation can induce the formation of α-Fe and $Nd_2Fe_{14}B$ nanocrystals in the amorphous matrix and then suppress the formation of metastable intermediate phases during thermal annealing. The volume fraction of α-Fe phase in the magnets increases as the strain increases，and the grain size of α-Fe and $Nd_2Fe_{14}B$ phases significantly decreases. As a result, the bulk magnets made at ε = 6.2 show enhanced magnetic properties, $(BH)_{max}$ = 17.8 MGOe and H_c = 7.2 kOe, compared with that of directly annealed partially amorphous (Nd-Pr)-Fe-Co-Nb-B, $(BH)_{max}$ = 12.2 MGOe and H_c = 6.2 kOe.

Keywords: strain; severe plastic deformation; microstructure; magnetic properties; nanocomposite magnets