Abstract Submitted
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Nanoscale Engineering Toward Bulk Exchange-Spring Permanent Magnetic Fe/MnAl Nanocomposites[1] LUKE G. MARSHALL, IAN J. MCDONALD, LAURA H. LEWIS, Department of Chemical Engineering, Northeastern University, Boston, MA 02115, USA — The ability to amplify the performance of exchange-spring nanocomposites through correlation and tailoring of chemical order, microstructural scale and magnetic response is necessary for the development of novel high-performance permanent magnets. To this end, rapid solidification of near-equiatomic MnAl for incorporation into the model exchange-spring Fe/MnAl system has produced alloys containing 20-30% ferromagnetic τ-MnAl with the high-temperature parent hexagonal ϵ-MnAl phase composing the balance. While typically formed by briefly annealing the quenched ϵ-phase, this work has confirmed direct attainment of nanoscaled τ-MnAl via cryogenic milling. Magnetic and structural data indicate a significantly decreased chemical order accompanied by increased lattice strain with increased milling time. Control of the chemical order and nanostructure of near-equiatomic MnAl will favor metastable configurations to foster robust exchange coupling between τ-MnAl and α-Fe to create high performance magnetic nanocomposites.

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