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Effects of Annealing on the Structure and Properties of $\mathbf{Mn_{5-x}Fe_xSi_3}$ ZACHARY SPENCE, CODY DAWSON, PEGGY HILL, Department of Physics & Engineering Physics, Southeast Missouri State University, IGOR DUBENKO, ABDIEL QUETZ, NAUSHAD ALI, Department of Physics, Southern Illinois University-Carbondale — Materials forming with the Mn_5Si_3 crystal structure have been found to exhibit interesting magnetic, magnetocaloric, and spin polarization properties. In particular, alloys of $Mn_{5-x}T_xSi_3$ (T = transition metal) have been investigated as possible magnetocaloric materials. Previous research has shown that $Mn_{5-x}Fe_xSi_3$, with x = 4, exhibits the largest magnetic entropy of the system (4 J/kgK) and orders ferromagnetically just below 300 K, making it a possible candidate for room temperature magnetic refrigeration applications.[1] Our work aims to study changes in the magnetic and magnetocaloric properties of $MnFe_4Si_3$ as a result of substitution at the silicon site. The effect of annealing, without quenching, on crystal structure homogeneity was investigated for the parent compounds Fe_5Si_3 and Mn_5Si_3 and for Mn_4FeSi_3 by x-ray diffraction. A reduction in x-ray diffraction peaks due to impurities was observed after annealing the Mn_5Si_3 and Mn_4FeSi_3 samples. The x-ray profile of Fe_5Si_3 was greatly improved by annealing and it adopted the proper Mn_5Si_3 $D8_8$ hexagonal crystal structure without quenching.

[1]Songlin, et al., J. of Alloys and Compounds. **334** (2002) 249

Margaret Hill
Department of Physics & Engineering Physics,
Southeast Missouri State University

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