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Reversible magnetocaloric effect and Critical exponent analysis in Mn-Fe-Ni-Sn Heusler alloys

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Abstract

We report the magnetic and magnetocaloric properties of $Mn_{48-x}Fe_xNi_{41}Sn_{11}$ (x = 8.5, 10.5) Heusler alloys. The temperature dependent magnetization curve (M vs T curve) reveals that these alloys show only second order ferromagnetic (FM) to paramagnetic (PM) transition at their Curie temperature (T_C) and no structural transformation is observed. A large value of saturation magnetization (M_S) ~ 72.76 Am^2/kg is observed at 80 K for x = 8.5 alloy as the alloy becomes purely austenite for this composition. A reversible magnetic entropy change of 1.02 $JKg^{-1}K^{-1}$ with moderate refrigerant capacity (RC) ~ 40.2 J/kg are obtained near room temperature (~305 K) for x = 8.5, across its T_C due to a field change of 14 kOe only. The critical exponents are calculated for both the samples and found to exhibit long range ferromagnetic ordering in their austenite phase.

Keywords: Heusler alloy; Magnetocaloric effect; Magnetic entropy change; Magnetic refrigeration; Refrigeration capacity; Saturation magnetization.

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