The existence of large magnetocaloric effect at low field variation and the anti-corrosion ability of Fe-rich alloy with Cr substituted for Fe

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Abstract: The influence of Cr substituted for Fe in $Fe_{78-x}Cr_xSi_4Nb_5B_{12}Ag_1$ ribbons on the crystallization and magnetic properties including the magnetocaloric effect have been investigated. DSC measurements showed that the crystallization temperature and the crystallization activation energy increased with Cr content. Thermomagnetic curves measured in low applied field indicated that there is a sharp ferromagnetic-paramagnetic phase transition at Curie temperature, T_C, of the amorphous phase. In addition, substitution of Cr for Fe led to approximate linear decrease of T_C with Cr content, namely from 450K to 280K for x 0 and x 8, respectively. From a series of the isothermal magnetization curves M(H) measured at different temperatures, magnetic entropy change $??S_m$ was determined at magnetic field variations of 13.5, 10.0 and 5.0 kOe. Maximum value of $??S_m$ (occurred near T_C) decreased with increasing Cr content and these values established are quite large at low field variation. Namely, at moderate low magnetic field variation of 5.0 kOe, $|??S_m|_{max}$ is of 4.4 and 1.9 J/kg.K for x 0 and x 8, respectively. Our studied alloys system could be considered as the best magnetocaloric material candidates for magnetic refrigeration because of colossal magnetic entropy change at low field variation and working temperature could be controlled in large region by substitution effect. The anti-corrosion ability of alloys was also examined. ?? 2009 IOP Publishing Ltd.

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