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Giant Magnetocaloric Effects on $MnFeSb_{1-x}Sn_x$ (x=0.8, 0.9, 1.0) Compounds

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The magnetocaloric effect (MCE) is the phenomenon related to magnetic material temperature change caused by a variation of applied magnetic field magnitude.[1]. It can be measured directly (adiabatic temperature change, ΔT_{ad}) or it can be calculated indirectly from the measured magnetization (magnetic entropy change, ΔS_M). Recently a giant MCE (GMCE) was discovered in $Gd_5(Si_xGe_{1-x})$ alloys, where $x \leq 4$ and $MnFe(P_{1-x}As_x)$ compounds, where $0.15 \leq x \leq 0.65$). The GMCE in these materials is associated with the strong first-order magnetic and structural transitions near the respective Curie temperature. The Curie temperature is strongly dependent on the alloy composition and its first order nature is preserved even in high magnetic fields [2, 3]. However, with the use of $Gd_5(Ge_{1-x}Si_x)_4$ compounds and $MnFe(P_{1-x}As_x)$ compounds as refrigerants some disadvantages are also associated since Gd is rather expensive and slightly souble in water and As is a toxic element. So, in this work, we investigate the MCE in Mn-Fe-Sb compunds without As.

The $MnFeSb_{1-x}Sn_x$ (x= 0.8, 0.9, 1.0) samples were prepared by conventional arc melting method in argon atmosphere. For homogeneity of samles, ingot was melted several times. And then, the heat treatment was carried out at 1100 K in a sealed quartz tube for 7 days and quenched in ice water. Quenching is believed to be important to obtain a high chemical order for this kind of alloys. The samples were examined by the X-ray diffraction and showed the single phase. The magnetic characteristics were performed with a Quantum Design superconducting quantum interference device (MPMS mode) magnetometer in the fields up to 50 kOe. The magnetic entropy change is calculated by the isothermal magnetization measurements.

As Sn content is increased, Curie temperature is inecreased and, the maximum entropy change is seen about Curie temperature in all samples. Our results show that the Mn-Fe-Sb-Sn alloys have a good magnetocaloric effect, indicating that these alloys can be considered as candidates for magnetic refrigeration applications.

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Electrodeposition of CoNiP Nanowires using Polycarbonate Membrane

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Hard magnetic nanowires are much interested because of their potential applications in high density perpendicular magnetic recording media and micro-electromechanical systems. Among the different magnetic nanowires, Co based nanowires has been attracted much attention because of its large crystalline anisotropy when it is in the hexagonal close packed (hcp) structure. There have also been electrodeposition studies of CoNiP for magnetic applications. As the CoNiP films are having hard magnetic properties, electrodeposition provides a easy way to produce these magnetic nanowires. A few electrodeposition studies have been carried out in order to understand the magnetic properties of CoNiP films only. Since there were few reports concerning CoNiP nanowires and their magnetic properties, in this communication, we study the structure and properties of CoNiP nanowires electrodeposited in commercially available polycarbonate track-etched membranes. An array of electrodeposited CoNiP hard magnetic nanowires was grown in polycarbonate membrane with pore size of 50 nm and length of 6μm. We observed three different nanowire lengths 1.21 μm, 4.31 μm and 6 μm at three different deposition times 30 min, 90 min, and 150 min, respectively. The X-ray diffraction patterns of cobalt nanowires indicate that CoNiP wires were grown with a mixture of fcc and hcp phases with a preferential orientation close to the perpendicular direction of the wire axes. The aim of this work focuses on structural and magnetic properties of the CoNiP nanowire and were measured by SEM (Scanning electron microscope) and VSM (Vibrating sample magnetometry) respectively.

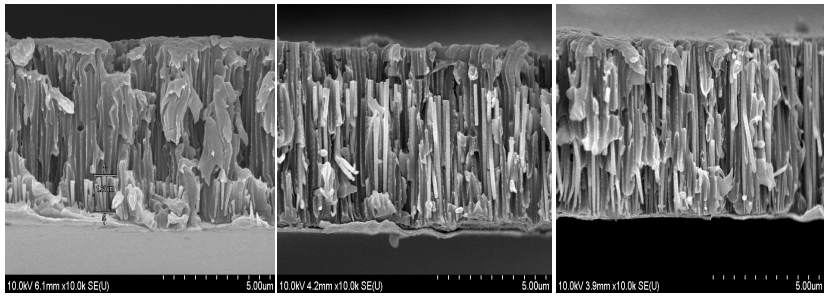

Fig. 1. Cross-sectional SEM images of the CoNiP nanowires with lengths 1.21, 4.31 and 6 μm.

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