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Magnetic Properties and Giant Magnetocaloric Effects on Gd-Ge-Si Alloy by Substitution of Sn

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The temperature change of a magnetic material associated with an external magnetic field change in an adiabatic process is defined as the magnetocaloric effect (MCE), which was discovered in iron by Warburg[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 $x \leq 4$. This property makes these alloys potential candidates for magnetic refrigeration in the range of 20-276 K. 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 (H = 7T)[2]. Therefore, the works on this matter are focused in materials that present first order transition, since they have intense entropy variation.

The $Gd_2Ge_{1-x}SiSn_x$(x = 0.01, 0.02, 0.03) 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 110 K in a sealed quartz tube for 9 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 decreased and, the maximum entropy change is seen about Curie temperature in all samples. Our results show that the Gd-Ge-Si-Sn alloys have a good magnetocaloric effect, indicating that these alloys can be considered as candidates for magnetic refrigeration applications.

REFERENCES

[1] E. Warburg, Ann. Phys. 13, 141 (1881).
[2] Pecharsky, V.K.; Gschneidner Jr., K.A. Phys. Rev. Lett., 78(23), 4494 (1997).

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Conversion of Conventionally Synthesized Strontium Hexaferrite Powder into a Nano Size Powder with Enhanced Coercivity Using GTMR1) Method

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M-type strontium hexaferrites have been widely used as permanent magnets and show promising properties in microwave devices, magneto-optical and perpendicular recording Media [1]. For preparation of Sr-hexaferrite nanoparticles different production methods such as sol-gel auto-combustion [2, 3] and heat treatment in the static atmosphere of hydrogen [4] has been reported in the last few years.

In the current research, the effects of dynamic atmosphere of H_2, CO and CH_4 following by low energy milling and re-calcination processes on the phase evolution, morphology and size of the particles and magnetic properties of conventionally synthesized Sr-hexaferrite were investigated using XRD, SEM and VSM techniques.

The results show that the coercivity of the initial powder has increased dramatically, in the best case, from 278.53 kA/m to 453.61 kA/m by GTMR process. The effect of this process on conversion of the initial powder to a nanopowder can also be seen in Fig. 1.

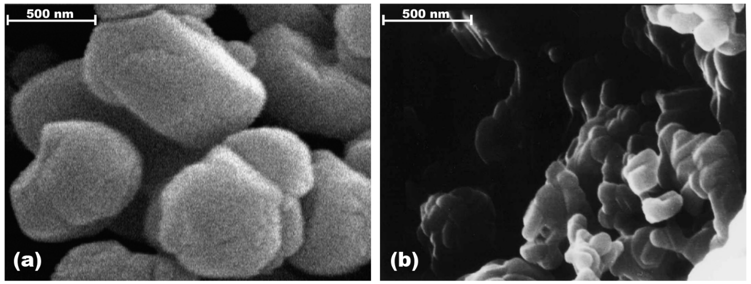

Fig. 1. The comparative SEM Images of conventional powder: a) before and b) after GTMR process.

REFERENCES

[1] J. Qiu, H. Shen, M. Gu, Powder Tech. 154, 116-119 (2005).
[2] S. Alamolhoda, S. A. Seyyed Ebrahimi, A. Badiei, J. Magn. Magn. Mater., 303, 69-72(2006).
[3] M. Ghobeiti Hasab, S. A. Seyyed Ebrahimi and A. Badiei, J. Magn. Magn. Mater., 310, 2477-2479 (2007).
[4] S. A. Seyyed Ebrahimi, Key. Eng. Mater, 280-283, 465-466 (2005).

1)Gas Treatment, Milling and Recalcination