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# ABSTRACTS

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advantage of the light-weight and corrosion resistant carbon-based nanomaterials with excellent dielectric properties, the reduced graphene oxide (rGO)/FFSS mixture powders were prepared by ball milling of rGO and FFSS for 40 hr. The aspect ratios of raw FSS powder are in the range of 5-25 while those of FFSS powder increase to the range of 50-180. The complex permittivity and permeability of FSS, FFSS and rGO/FFSS fillers mixed with epoxy resin respectively were measured using a transmission/reflection method in 2-18 GHz. The results illustrated that the electromagnetic properties ($\varepsilon'$, $\varepsilon''$, $\mu'$, $\mu''$) both increase significantly after ball milling. The rGO/FFSS/epoxy composite exhibited higher dielectric loss and lower reflection loss than those of FFSS/epoxy composites. The minimum reflection loss of 40 wt% rGO/FFSS/epoxy composite reached –20.1 dB at 9.1 GHz for a matching thickness of 2 mm and –40.0 dB at 6 GHz for 3-mm thickness.

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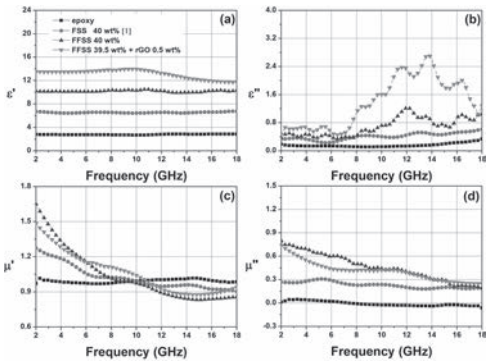


**Fig 1. (a) Real part and (b) imaginary part of complex permittivity, (c) real part and (d) imaginary part of complex permeability of raw FSS/epoxy, FFSS/epoxy, and rGO/FFSS/epoxy composites.**

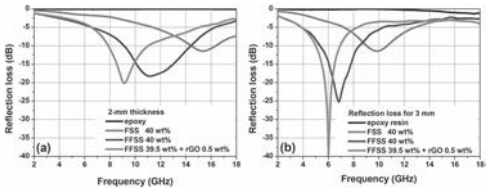


**Fig 2. The reflection loss of raw FSS/epoxy, FFSS/epoxy, and rGO/FFSS/epoxy composites with (a) 2-mm and (b) 3-mm thickness.**

**FV-09. Study on magnetocaloric effect investigated by crystallographic and magnetic properties of $Mn_{1-x}{}^{57}Fe_xAs$ (x = 0.001, 0.003, 0.005).**

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The $Mn_{1-x}{}^{57}Fe_xAs$ (x = 0.001, 0.003, 0.005) compounds for magnetic refrigeration application were synthesized by using solid-vapor reaction method. We have investigated the crystallographic and magnetic properties of $Mn_{1-x}{}^{57}Fe_xAs$ (x = 0.001, 0.003, 0.005) samples by using x-ray diffractometer (XRD), high-resolution powder neutron diffractometer (HRPD), vibrating sample magnetometer (VSM), superconducting quantum interference device (SQUID), and Mössbauer spectrometer. From the XRD patterns analyzed by Rietveld refinement, below Curie temperature ($T_C$), all samples confirmed to be hexagonal space group $P6_3/mmc$, while above $T_C$ all samples confirmed to be orthorhombic space group *Pnma*. The unit cell volume ($V_u$) decreases with increasing Fe ion contents because the ionic radius of Mn ions are larger than that of Fe ions as expected from the Vegard's law. All samples were carried out the temperature-dependent magnetization curves under 200 Oe between 4.2 and 320 K and showed a large hysteresis in the magnetization as a function of the temperature. The result indicates that first-order phase transition is accompanied by ferromagnetic-paramagnetic transition. With increasing Fe ion contents, the $T_C$ were linearly decreases due to the reduction of $V_u$. The value of magnetic entropy ($-\Delta S_M$), to analyze the magnetocaloric effect, was calculated by the isothermal initial curves up to 5 T at various temperatures. The maximum value of $-\Delta S_M$ of the $Mn_{1-x}{}^{57}Fe_xAs$ (x = 0.001, 0.003, 0.005) change caused by field of 5 T were 179.02, 270.00, and 159.00 J/kgK at 306.25, 301.75, and 298.75 K, respectively. Mössbauer spectra of $Mn_{1-x}{}^{57}Fe_xAs$ (x = 0.001, 0.003, 0.005) samples were taken at various temperatures ranging from 4.2 to 320 K, and below $T_C$, the obtained spectra were analyzed as two-doublets for Fe sites, while above $T_C$ the obtained spectra showed singlet. With increasing temperature, the Mössbauer spectra of all samples showed asymmetric doublet due to the Glodanskii-Karyagin effect.

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**FV-10. Large rotating magnetocaloric effect in $ErAlO_3$ single crystal.**

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Magnetic refrigeration based on magnetocaloric effect (MCE) has attracted much research interest. In the past twenty years, MCE research mainly focused on materials with magnetic phase transitions that induce large MCE near the transition temperature. Recently, rotating MCE based on changing the magnetic anisotropy energy in a constant magnetic field is focused due to the simplification and possible miniaturization of the device [1]. $NdCo_5$, $BaCo_{0.62}Zn_{1.38}Fe_{16}O_{27}$, $Er_2Fe_{14}B$, $RMnO_3$, $RMn_2O_5$, and $RFeO_3$ are reported to exhibit this kind of MCE. In this work, we report the anisotropic magnetic properties and rotating field MCE for $ErAlO_3$ single crystal. Polycrystalline $ErAlO_3$ was prepared by solid-state reaction and the single crystal was grown from the polycrystalline rod by the floating zone method. X-ray diffraction (XRD) pattern of powdered sample of single crystal at room temperature reveals that the material is single phase with the orthorhombic structure (Space group $p_{nma}$; No. 62, Z=4). The lattice parameters are found to be *a*=5.333(6) Å, b=7.365(0) Å and *c*=5.167(5) Å. A back-reflection Laue XRD experiment was carried out to check the single crystallinity and determine the crystallographic direction. Magnetization measurements were performed on a commercial superconducting quantum interference device magnetometer. $ErAlO_3$ single crystal along *a*, *b* and *c* axes equally display paramagnetic behavior above 2 K. Both field and temperature dependence of magnetization shows that the system is highly anisotropic in the paramagnetic state. *a* and *b* axes are isotropic of magnetization. *c* axis is much easier to be magnetized than *a* and *b* axes. Correspondingly, the magnetic entropy change is extremely sensitive to the direction of applied field. For a field change of 0-5 T, the rotating field entropy change from *b* to *c* axis reaches a large value of 9.7 J/kg K at 14 K. Therefore, $ErAlO_3$ single crystal can be a promising candidate for rotating field magnetic refrigeration.

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