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ABSTRACTS

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MIH- T curve and the MIH takes almost constant value below the bending temperature. Since this bending temperature corresponds to the Néel temperature determined from the heat capacity measurements, we identify the temperature independent susceptibility as the perpendicular susceptibility of an anisotropic antiferromagnet. We also observed a change in the M- H curves of NDMAP. The magnetic field when M changes corresponds to the phase boundary between the field induced LRO and paramagnetic phases determined from the heat capacity measurements.


Based on a model of atoms randomly distributed on a cubic lattice, the atomic disorder induced in quenched binary alloys has been simulated. The study has been developed within the framework of a random site-diluted Ising model with nearest-neighbor interactions and by using a Monte Carlo algorithm implemented with Metropolis kinetics for sampling states. After equilibration, ensemble and configurational averages for magnetization, magnetic susceptibility and heat capacity were computed. It is concluded that, in agreement with previous experimental Mossbauer data for which a comparison is carried out, the Fe-Al disordered alloys exhibit room temperature ferromagnetic behavior up to around 42 at.% Al beyond which the system becomes paramagnetic. This result contrasts with that for alloys with atomic order that exhibit ferromagnetism only up to 30 at. % Al. Finally, a finite size scaling analysis for the simulated system was also performed.


Charge transfer type Gd<sub>1-x</sub>Sr<sub>x</sub>FeO<sub>3</sub> was synthesized, and its magnetic properties were investigated by neutron diffraction and Mossbauer spectroscopy at various temperatures ranging from 4.2 K to room temperature. The magnetic lattice constant with rhombohedral represents a<sub>0</sub> = 5.457 Å, and c<sub>0</sub> = 60.122 Å. The Magnetic hyperfine fields at 4.2 K show 469 kOe for Fe<sup>3+</sup> and 243 kOe for Fe<sup>2+</sup>. The spin rotation resulting from helical spin of Nd was observed at below 25 K. The electric quadrupole splitting which is for Fe<sup>3+</sup> and Fe<sup>2+</sup> is 0.07 and 0.15 (mm/s) at 4.2 K, which values were changed -0.06 and -0.02 (mm/s) at and above 20 K. It is an important evidence of spin rotation exists in Gd<sub>1-x</sub>Sr<sub>x</sub>FeO<sub>3</sub> from 4.2 to 20 K. The powder neutron diffraction exhibits magnetic ordering structures. The Gd<sub>1-x</sub>Sr<sub>x</sub>FeO<sub>3</sub> with least lattice distortion underwent a charge ordering(CO) phase-transition at and below T<sub>CO</sub> = 163 K corresponding sequence of Fe<sup>3+</sup>Fe<sup>3+</sup>Fe<sup>3+</sup>Fe<sup>2+</sup>Fe<sup>2+</sup>Fe<sup>2+</sup>Fe<sup>2+</sup>Fe<sup>2+</sup> exists aligned along the -direction of rhombohedral as well as canted antiferromagnetic spin ordering.


Iron sulfide FeS exhibits interesting magnetic and crystallographic phase transition. In the neighborhood of T<sub>n</sub>~400K, a crystallographic phase transition appears, usually called the α transition. FeS exists with a hexagonal NiAs structure above T<sub>n</sub> and transform below T<sub>n</sub> to a hexagonal superstructure having a unit cell six times as neutron-diffraction measurements show that of the NiAs structure above T<sub>n</sub>. Magnetic susceptibility and temperature of about 600K and that the spin direction changes from perpendicular to parallel with the c axis below this temperature, the spin-rotation temperature T<sub>M</sub> (Morin transition temperature). It is found that Mossbauer measurements on Fe<sub>0.325</sub>S(O,75) (M=Sc, Ti, V, Cr, Mn, Co, Ni, Cu) that the 3d-transition metal impurities profoundly affect both the crystallographic, and spin rotation transitions of iron sulfide in this research. It is evident that there is no definite relationship between the lattice parameters and the number of 3d electrons. However, it is noteworthy that V<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc and C<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc have lattice parameters which are distinctly different from those of FeS; furthermore, the directions of change of the lattice parameters are opposite for V<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc and C<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc. a<sub>0</sub> of V<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc is much less than that of FeS while a<sub>0</sub> of C<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc is much larger than that of FeS. On the other hand, c<sub>0</sub> of V<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc is larger than that of FeS whereas c<sub>0</sub> of C<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc is less than that of FeS. It is noteworthy that both V<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc and C<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc have Morin transition temperatures T<sub>M</sub> which are distinctly different from that of FeS; furthermore, the rections of changes of T<sub>M</sub> are opposite for V<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc and C<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc. A vanadium impurity of 2.5% of the metal atoms if the iron sulfides makes the crystallographic transition in FeS take place rapidly in a narrow temperature region of about 15K, while the α transition in FeS takes place over a wide temperature range of about 200K. It is also found that the α transition for V<sub>Fe</sub>0.25Fe<sub>0.75</sub>Sc has a hysteresis width of 5K.

**FQ-08. The magnetic phase transition in Fe<sub>2</sub>Ho single crystal. R. A. Silva, A. A. Coutinho, C. S. Alves and S. Gama (Universidade Estadual de Campinas - IFGW, DFA - GPCM, C.P. 6165, Campinas, SP, 13083-910, BR)**

In order to investigate the magnetic phase transition in Fe<sub>2</sub>Ho single crystal, we have prepared high quality single crystal of Fe<sub>2</sub>Ho alloy using the conventional Czochralski technique. A 1.2 mm diameter sphere was cut by spark erosion. The magnetic behaviour of Fe<sub>2</sub>Ho single crystal is investigated by measuring the magnetic moment in the critical regime and in the paramagnetic regime for applied fields from 10 mT to 4 T. The Fe<sub>2</sub>Ho phase shows a ferromagnetic phase transition, and the critical exponents of this transformation β, γ, β and δ are determined by modified Arrot plots, scaling plots, in J vs. lnμ, H plots and the method of Kouvel and Fisher. Well-defined phase transition is found to exist in this system with the values of the asymptotic critical exponents and the universal amplitude ratios very close to those predicted by the renormalization group calculations for a three-dimensional isotropic short-range Heisenberg ferromagnet.

**FQ-09. Metalization of magnetite (Fe3O4) under high pressure. Sakae Todo, Nao Takehita, Takahiro Kasehara, Tamiko Mori, and Nobuo Mori (Univ. of Tokyo, Inst. for Solid State Phys., 5-1-5 Kashiwaraoa, Kashiwa, Chiba, 277-8581, JP)**

Electrical resistivity measurements have been made on a good qualified single crystaline magnetite(Fe3O4) at temperatures from 300 K down to 3.0 K under high pressure up to 10 GPa. A steep change in resistivity at the Verwey transition temperature has been observed even at pressures over 3.5 GPa, which shows a quite distinct result reported in prior work(1). Moreover, the Verwey transition temperature has been found to decrease non-linearly with increasing pressure and surprisingly it disappears at around 8 GPa. Above 8 GPa magnetite exhibits metallic behavior. The residual resistivity ratio(RRR) of the metallic state is observed to be more than 300. This is the first finding of a metallic magnetite.


Temperature (4.3-300 K) and magnetic field (0-100 kOe) dependencies of the electrical resistance and heat capacity of Gd<sub>2</sub>Ge<sub>4</sub> are quite different when compared with those in other Cd-based intermetallic compounds. The resistivity of Gd<sub>2</sub>Ge<sub>4</sub> in general is similar to [1] and has metallic-like
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*M/H-T* curve and the *M/H* takes almost constant value below the bending temperature. Since this bending temperature corresponds to the Néel temperature determined from the heat capacity measurements, we identify the temperature independent susceptibility as the perpendicular susceptibility of an anisotropic antiferromagnet. We also observed a change in the *M-H* curves of NDMAP. The magnetic field when *M* changes corresponds to the phase boundary between the field induced LRO and paramagnetic phases determined from the heat capacity measurements.


**FQ-05. Magnetism of Fe-Al Disordered Alloys: An Ising-Monte Carlo Approach.** J. Restrepo (Universidad de Antioquia, Departamento de Fisica, A. A. 1226, Medellin, Antioquia, CO), G. A. Perez Alcazar (Universidad del Valle, Departamento de Fisica, A. A. 25360, Cali, Valle, CO), and D. P. Landau (The Univ. of Georgia, Ctr. for Simulatioanal Phys., Athens, Georgia, 30602-2451, US)

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**FQ-06. Magnetic properties of Nd12Sr3FeO15 by neutron diffraction and Mossbauer studies.** Young Bang Ohn and Chul Sung Kim (Kookmin Univ., Dept. of Phys., Sungbukgu, Seoul, 136-702, KR)

Charge transfer type Nd12Sr3FeO15 was synthesized, and its magnetic properties were investigated by neutron diffraction and Mossbauer spectroscopy at various temperatures ranging from 4.2 K to room temperature. The area of the magnetic field dependence of the magnetic susceptibility at 4.2 K show 469 Ioe for Fe3+ and 243 Ioe for Fe5+. The spin rotation resulting from htbm spin of Nd was observed at below 25 K, and the electric quadrupole splitting which is for Fe3+ and Fe5+ is 0.07 and 0.15 (mm/s) at 4.2 K, which values were changed -0.06 and -0.02 (mm/s) at and above 20 K. It is an important evidences of spin rotation exists in Nd12Sr3FeO15, from 4.2 to 20 K. The powder neutron diffraction exhibits magnetic ordering. The Nd12Sr3FeO15 with least lattice distortion underwent a charge ordering(CO) phase-transition at and below TCO = 163 K corresponding sequence of Fe3+Fe3+Fe5+Fe3+Fe5+ exists aligned along the z-direction of rhombohedral as well as canted antiferromagnetic spin ordering.


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rotation temperature T_M (Morin transition temperature). It is found that Mossbauer measurements on M_0.03FeO1.973 (M=Sc, Ti, V, Cr, Mn, Co, Ni, Cu) that the 3d-transition metal impurities profoundly affect both the crystallographic, and spin rotation transitions of iron sulfide in this research. It is evident that there is no definite relationship between the lattice parameters and the number of 3d electron. However, it is noteworthy that V_0.03FeO1.973S and Co_0.02FeO1.973S have lattice parameters which are distinctly different from those of FeS; furthermore, the directions of change of the lattice parameters are opposite for V_0.03FeO1.973S and Co_0.02FeO1.973S. a_0 of V_0.03FeO1.973S is much less than that of FeS while a_0 of Co_0.02FeO1.973S is much larger than that of FeS. On the other hand, c_0 of V_0.03FeO1.973S is larger than that of FeS whereas c_0 of Co_0.02FeO1.973S is less than that of FeS. It is noteworthy that both V_0.03FeO1.973S and Co_0.02FeO1.973S have Morin transition temperatures T_M which are distinctly different from that of FeS; furthermore, the rections of changes of T_M are opposite for V_0.03FeO1.973S and Co_0.02FeO1.973S. A vanadium impurity of 2.5% of the metal atoms if the iron sulfides the magnetic transition in FeS take place rapidly in a narrow temperature region of about 15K, while the α transition in FeS takes place over a wide temperature range of about 200K. It is also found that the α transition for V_0.03FeO1.973S has a hysteresis width of 5K.

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