MMM2020

Virtual Conference

65th Annual Conference on Magnetism and Magnetic Materials

ABSTRACTS

AIP Publishing

IEEE MAGNETICS

Jointly sponsored by AIP Publishing LLC, and The IEEE Magnetics Society

F5-08. Crystalline Structure and Magnetic Properties of Pyrite FeS_2.

H. Choi[1], J. Seo[1], Y. Uhm[2], G. Sun[2] and C. Kim[1] *1. Department of Physics, Kookmin University, Seoul, The Republic of Korea; 2. HANARO Operation and Utilization, Korea Atomic Energy Research Institute, Daejeon, The Republic of Korea*

Iron pyrite (FeS_2) are recognized significant attention as promising inorganic materials applications, such as electrode materials for high-energy batteries, medical diagnostics, semiconductor materials, and photovoltaic solar cells. In this paper, we provide that the crystalline structure and magnetic properties of pyrite FeS_2 were characterized with X-ray diffraction (XRD), vibrating sample magnetometer (VSM), and Mössbauer spectroscopy. From the refined XRD patterns, it was confirmed that the crystalline structure of FeS_2 was cubic pyrite (P*a-3* space group) with the lattice constants of a_0 = 5.4176 Å. The hysteresis loops of FeS_2 were measured by VSM in the maximum applied field of 10 kOe at 4.2 and 295 K. As shown in Fig. 1, the saturation magnetization at 4.2 and 295 K was 0.123 and 0.035 emu/g, respectively. Mössbauer data were collected in the temperature range of 4.2-500 K. The spectra at all temperature were fitted one-doublet. The Mössbauer spectra of FeS_2 at 4.2 and 295 K are shown in the inset of Fig. 1. The electric quadrupole splitting (ΔE_Q) values are 0.63 and 0.60 mm/s for 4.2 and 295 K, respectively. The ΔE_Q values with decreasing temperatures increases slightly due to changes in the Fe-S distance. The isomer shift (δ) values are 0.28 and 0.18 mm/s for 4.2 and 295 K, indicating the Fe^{3+} state. The temperature dependence of δ values is due to the second order doppler shift.

[1] Z. Meng, F. Wei, W. Ma, etc., Adv. Funct. Mater., Vol. 26, p.8231 (2016).

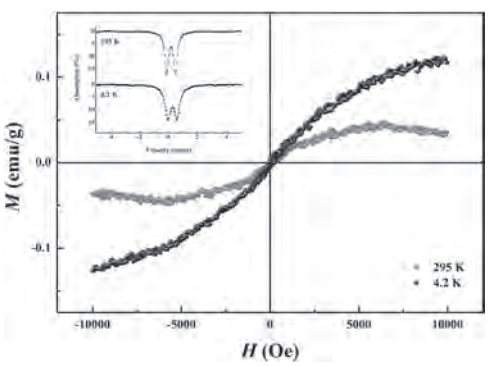

Fig. 1. Hysteresis loops and Mössbauer spectra of FeS_2 at 4.2 and 295 K.