The 8th International Conference on Advanced Materials and Devices
ICAMD 2013
December 11~13, 2013 Ramada Plaza Jeju Hotel, Jeju, Korea

Organized by
KPS Applied Physics Division, The Korean Physical Society
Quantum Metamaterials Research Center
CNRS–Ewha International Research Center (CERC)
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Magnetic properties of iron catalyst synthesized by various CO$_2$ concentration

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The 100Fe/5.26Cu/4.76K/18.2SiO$_2$ in part per weight were synthesized by Fischer-Tropsch (F-T) method (Flow rate of H$_2$+CO = 2.8 NL/g(cat)-h, H$_2$/CO = 1/1, T = 280 °C, P = Ambient, Time = 20 h). The samples were located under the variable amount CO$_2$ with H$_2$+CO gas (Volume ratio S1: H$_2$/CO=1/1, S2: H$_2$/CO/CO$_2$=1/1/0.5, S3: H$_2$/CO/CO$_2$=1/1/1, S4: H$_2$/CO/CO$_2$=1/1/2). X-ray diffractometer (XRD) pattern showed that dominant phase changes from ε-Fe$_{2.2}$C (carbide) and χ-Fe$_3$C$_2$ (hagg-carbide) to Fe$_3$O$_4$ (magnetite) and Fe$_5$O$_7$(OH)4H$_2$O (ferrihydrite) by increasing content of CO$_2$. The magnetic properties of samples were investigated by vibrating sample magnetometer (VSM). From the magnetic hysteresis curves up to 15 kOe at 295 K, the saturation magnetization($M_s$), and coercivity($H_c$) of samples (S1, S2, S3, S4) were measured to be $M_s$ = 34.275, 24.336, 21.209, and 12.317 emu/g and $H_c$ = 605.02, 925.88, 1197.0, and 910.88 Oe, respectively. The $M_s$ decreased with increasing content of CO$_2$. But, coercivity was the highest for S3. Mössbauer spectra of all samples were obtained and analyzed at various temperatures ranging from 4.2 to 295 K. Mössbauer spectra shows typical sextet and doublet at 295 K. With increasing CO$_2$ contents, doublet of sample increases. The result of Mössbauer spectra agree well with that of XRD pattern.