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Magnetic properties of iron catalyst synthesized by various CO_2 concentration

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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 ^oC, 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_5C_2 (hagg-carbide) to Fe_3O_4 (magnetite) and $Fe_5O_7(OH)4H_2O$ (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.