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The Raman Study of the Uranium Doped Cuprate Based Quasi One-dimensional Antiferomagnet

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Recent interests were seen for the uranium doped ceramics because of observed significant improvement in the flux pinning properties of the uranium doped high T_c superconductors [1]. This paper reports the structure and the Raman scattering study for the cuprate based quasi 1D antiferromagnetic system Ca_2CuO_3:U (x=0-0.05) prepared by the sol-gel method. The samples exhibit the semiconductor character continuously from the room temperature downto thetemperature region near 27K where the break from the covalent-insulator state was observed. This turning away from the covalent insulation state has happened for the first time in this class of compounds. We also identified the conduction mechanism in the region above 27K as the possible phonon-assisted electron hoping between the uranium sites in the lattice [2].

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Relation between Mössbauer Spectroscopy and Geometrical Frustration Factors in $MCr_{1.98}{}^{57}Fe_{0.02}O_4$ (M = Co, Zn)

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In order to elucidate the role of Cr ions in MCr_2O_4(M = Co, Zn) exhibiting geometrically frustration and multiferroic property[1, 2], we have substituted a small amount of Fe ions for Cr sites and investigated the magnetic behavior of Fe ions using by Mössbauer measurement. The spinel $MCr_{1.98}{}^{57}Fe_{0.02}O_4$ powders were prepared by wet chemical solution process. The crystal structure was found to be single-phase cubic spinel with space group of *Fd3m*. The lattice constants a_0 and the internal structural parameter (x) of the oxygen were determined to be 8.340, 8.331 Å and 0.261 and 0.260, respectively. Mössbauer spectra of $MCr_{1.98}{}^{57}Fe_{0.02}O_4$ were taken from 4.2 to 295 K using a ^{57}Co source in a rhodium matrix. The Mössbauer absorption spectra at 4.2K show that the well developed two sextets are superposed with small difference of hyperfine fields(H_{hf}). The hyperfine fields of $CoCr_{1.98}{}^{57}Fe_{0.02}O_4$ and $ZnCr_{1.98}{}^{57}Fe_{0.02}O_4$ were determined to be 490~480 kOe and 460~450 kOe, respectively. Isomer shift values (δ) of the two sextets are found to be 0.33~0.35 mm/s relative to the Fe metal, which are consistent with the high spin Fe^{3+} charge state. From the results of Mössbauer measurement, it is suggested that Cr^{3+} ions have two different magnetic sites, and is correlated between hyperfine fields and degree of magnetic geometrical frustration.

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