Experimental study of Cu(en)$(H_2O)_2SO_4$ embedded into mesoporous silica matrix SBA-15 with the hexagonal arrangement of pores

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In this work, we performed the experimental study of the complex Cu(en)$(H_2O)_2SO_4$ embedded into the pores of mesoporous silica SBA-15 with hexagonal pore symmetry. The highest pore-filling degree represents up to 60 percent of the total internal pore volume for the silica, which was synthesized for 72 hours in a saturated solution of Cu(en)$(H_2O)_2SO_4$. The magnetic properties of the given complex were carried out by the measurements of EPR spectra and magnetic susceptibility on the powder sample. They were further compared with experimental data obtained from previous studies on the bulk Cu(en)$(H_2O)_2SO_4$. The EPR experimental data were analyzed within the EasySpin software package, with a simple model including the anisotropic g-factors, hyperfine interactions, and EPR linewidth. The best agreement with experimental data measured at temperature 2.1 K was achieved for parameters g_z =2.33, $g_y = 2.10$, $g_x = 2.01$, $A_x = 125$ MHz, $A_z = 315$ MHz, $A_y = 100$ MHz, and $\Delta B = 7$ mT. Temperature dependence of the magnetic susceptibility for the synthesized complex shows the typical paramagnetic behavior at temperatures ranging from 0.4K to 1.8 K. A phase transition to a magnetically ordered state for the bulk crystals of Cu(en)$(H_2O)_2SO_4$ is located at $T_N = (0.91 \pm 0.02)$ K in zero magnetic field. However, for encapsulated complex into pores of SBA-15, no signs associated with the magnetic phase transition have been seen down to 0.4 K.

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