

Single ion magnets based on cobalt(II) carboxylate complexes

Kiskin Mikhail A.,^{1*} Nikolaevskii Stanislav A.,¹ Efimov Nikolay N.,¹ Baranchikov Alexander E.,¹ Veber Sergey L.,² Eremenko Igor L.¹

¹ Kurnakov Institute of General and Inorganic Chemistry of RAS, Leninsky prosp. 31, 119991, Moscow, Russia

² International Tomography Center SB RAS, Institutskaya 3a, 630090, Novosibirsk, Russia

*E-mail: mkiskin@igic.ras.ru.

Single Ion magnets (SIMs) are subject to significant research efforts from chemists and physicists due to their prospective applications in high-density information storage and molecular spintronics devices. To implement slow magnetic relaxation of paramagnetic metal-containing compounds, it is necessary that the metal ion possesses magnetic anisotropy (D). Magnetic anisotropy is determined by the electronic structure of the metal ion, as well as the electronic and spatial characteristics defined by its ligand environment. It has been proven that by controlling the geometry of the coordination environment of a 3d-metal ion, i.e., adjusting its crystal field and spin-orbit interaction, one can achieve relatively weighty values of the barrier to reorientation of magnetization. A related and no less important task facing researchers is the development of approaches associated with an increase in the relaxation times of the magnetization of such complexes. This can be achieved by minimizing dipolar spin-spin interactions between metal centers through magnetic dilution. Magnetic dilution with preservation of the original SIM structure should be carried out in an isostructural diamagnetic matrix, for instance, in a zinc complex of analogical composition, although, unfortunately, not all known SIMs are based on “magnetic” 3d-metal ions corresponds to the isostructural analogues of such diamagnetic compounds.

The report will discuss the results of studies on the synthesis of cobalt(II) carboxylate complexes, approaches to controlling the coordination environment of the metal center, crystal packing, and magnetic dilution in order to improve the operational characteristics of SIMs.

The authors are grateful to the Ministry of Science and Higher Education of the Russian Federation, grant number 075-15-2020-779, for financial support.