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Heterospin crystal: New sensor to the external pressure

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Stable organic radicals are valuable tools for solving a wide variety of fundamental problems. Among these, nitroxides are the most persistent organic paramagnets which widely used in the synthesis of heterospin compounds. Reactions between the transition metal and nitroxides are convenient and effective methods for the synthesis of different multispin molecules. The sensitivity of their magnetic properties to the local environment and intramolecular effects, as well as long half-lives, make them attractive tools in various fields, especially in molecular magnetism, biochemistry, biophysics and materials science. They are promising as contrast agents for magnetic resonance imaging. They have always attracted the attention of researchers as multispin building blocks, which were used for the synthesis of heterospin molecular magnets. Recently, Cu(II) complexes with nitroxides were used to create breathing crystals. When the temperature or/and pressure changes, the solid compounds undergo structural rearrangements accompanied by magnetic effects similar to spin crossover. The observed anomalies are caused by the reversible spatial dynamics of Jahn-Teller coordination units containing heterospin exchange clusters. The high mechanical stability of the multispin crystals, i.e., their ability to be reversibly compressed and expanded in the temperature range of phase transition, underlies the term 'breathing crystals'. Reversible single crystal to single crystal polymerization–depolymerization coordination reactions for a transition metal complex with stable organic radicals initiated by variation of temperature was found too. It was found that transition metal complexes with kinetically stable nitroxides are promising compounds that can serve as a new type of highly sensitive sensor to the external pressure. Noteworthy, structural rearrangements in breathing crystals can be essentially different. It depends on which parameter i.e. temperature or pressure was changed.

Biography

Victor Ovcharenko has his expertise in design of molecular magnets and investigation of spin transitions, "breathing crystals" and magneto-structural correlations in heterospin compounds. He developed new methods of selective synthesis of highly dimensional heterospin systems based on metal complexes with stable organic radicals, investigated magneto-structural correlations inherent in heterospin compounds, created a new type of breathing crystals and explained mechanical activity of these crystals (breathing crystals, jumping crystals, dancing crystals).

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