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Investigations of homochiral amino acids-based metal-organic frameworks in FLNP JINR

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Metal-organic frameworks (MOFs) are crystalline materials consisting of an infinite network of metal-ions, or metal-ion clusters, bridged by organic ligands through coordination bonds into porous two- or three- dimensional extended structures. MOFs are attracting increasing interest due to their unique properties such as magnetism, luminescence, high catalytic activity, gas storage and so on. An important area of use for MOFs is the adsorption of heavy metals. It is important for water purification from harmful ions (Pb2+, Cd2+, Hg2+) and for the extraction of valuable metal ions (Ru3+, Pd2+) from solutions. MOFs containing transition metals can be interesting because of the wide range of available metal oxidation states and coordination geometries. The use of chiral amino acids as building blocks for MOFs leads to chirality, biocompatibility and various modes of metal coordination. A new approach for the synthesis of homochiral porous coordination polymers was proposed [1]. A specific feature of this approach is the use in the synthesis of two simple ligands, namely, the chiral polyfunctional ligands forming chiral complexes with metal cations and the rigid bridging ligand that links these complexes to form a porous framework.
In the present work, we describe the synthesis and results of studying the structures and thermal stability of several metal-organic coordination polymers, with and without the rigid bridging ligand. In addition, these substances are interesting objects of Raman spectroscopy investigation. In particular, a new compound {[Ni(L-trp)(bpe)(H2O)]·H2O·NO3}n was synthesized (L-trp = L-tryptophan, bpe = 1,2-bis(4-pyridyl)ethylene). The dielectric, luminescence, and nonlinear-optic properties of such homochiral tryptophan-based MOF based on zinc were studied in [2]. These materials are stable in an aqueous medium. So, they can be interesting for the adsorption of heavy metals from aqueous solutions. In this work, special attention is paid to the hydrothermal synthesis of amino acids-based MOFs.

1. D.N. Dybtsev et al. Angew. Chem. Int. Ed., 2006, 45, № 6, 916-920.
2. Sh. Mendiratta et al. Cryst. Growth Des., 2014, 14, 1572–1579.

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