Synthesis and the properties studies of Prussian blue analogues nanorods

Molecular magnetism is still a new and dynamically developing research area from the borderline of physics, chemistry, and material engineering. Molecular magnets are an example of functional materials, which means that their properties change under the influence of external stimuli, such as magnetic or electric field, temperature, light or water content. Prussian blue analogues (PBA) are special and so far the best studied group of molecular magnets, where the magnetic interaction is carried out through cyanide bridges. Due to the appropriate selection of magnetic ions forming the structure of Prussian blue analogues, compounds with magnetic transition temperatures between 5 and 380 K can be obtained. Although many of the scientific papers have been devoted to Prussian blue analogues, where the magnetic properties of solid samples, thin films and nanoparticles were analysed, the papers devoted to nanowires are rather rare. Nanowires are long, quasi-one-dimensional objects with diameters in the nanoscale. Creating and investigation the properties of objects such as nanowires is very important because of their potential usage as the basis for spintronics devices, quantum computers or magnetic memories.

The main goal of the project is the synthesis and then systematic study of the properties of nanowires of Prussian blue analogues. Matrices of nanoporous alumina and polycarbonate were selected as the growth templates for nanowires. Deposition of material in the pores of these matrices will be obtained by electrochemical synthesis. The most important aspect of the research carried out within this part of the project will be to check the influence of the diameter of the obtained nanowires on their magnetic and structural properties. The successive reduction in the diameter of nanowires should be reflected in the change of parameters such as the value of the critical temperature or the coercive field. When this stage of the project will be implemented, our research will focus on the production of porous alumina matrices with a high degree of pore arrangement and then use them as templates for the growth of nanowires of Prussian blue analogues.

Characteristics of obtained nanomaterials will include morphology analysis using scanning electron microscopy (SEM), structural studies using infrared spectroscopy and X-ray diffraction (XRD) and magnetic properties measurements using a SQUID magnetometer.