**Physico-Chemical nanomaterials science**

**1D metallic nanostructures in flexible ion-track templates**

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One dimensional (1D) metallic nanostructures (NSs) including nanorods, nanowires and nanotubes are of great interest from the academic and manufacturing sectors for wide range of applications. It is important to find out cost-effective and versatile methods of NSs synthesis for adopting them to existing manifestation technology. 1D metallic NSs formation is usually based on hydrothermal and sol–gel synthesis, evaporation-condensation method, chemical and electrochemical deposition. In this variety a tremendous amount of interest in chemical or electrochemical approaches for the design of novel nanostructured materials and applications. These methods have been widely used in the industry for creation of anti-corrosion and decorative platings on the basis of metals and alloys. It is a cost-effective, also easy implemented and capable method for producing of a great number of materials. Due to these features, over the last few decades the demand for development of electrodeposition method for nanostructures creation has been considerably enhanced, and it has been successfully shared for production of a wide range of 1D metallic NSs with outstanding functional and mechanical properties.

The simplest way of control of properties of developed 1D metallic NSs is using of porous templates. The most common templates are anodic aluminum oxide (AAO), porous silica or polymeric membranes. Polymeric membranes are interesting for creation of metallic nanostructures on the elastic base for application in the field of flexible electronics. Ion-track technology is usually used to form polymeric membranes with predetermined pores parameters. It is based on an irradiation process of materials by swift heavy ions which form highly defective extended regions (latent tracks) inside the irradiated material. Selective etching of latent tracks provides opportunity to form membrane with determined geometry and sizes of pores. Template parameters as well as deposition conditions (time, electrolyte composition, temperature and voltage) allow to create metallic NSs with different shape and size.

Polyethylenetereftalate track membranes with 12 µm thicknesses and 50–500 nm cylindrical pores have been used as templates for synthesis of 1D metallic NSs (Fe, Co, Ni, Zn, Cu and their compositions) by electrodeposition. The influence of deposition parameters: temperature, voltage, time and composition of electrolyte were established. The necessary conditions for metallic nanotubes obtaining have been determined and depend of morphology transition from the nanowires to nanotubes on the increase of deposition temperature and voltage as well as the nanotubes wall thicknesses has been established. The rise of deposition rate leads to decrease in crystallinity degree, as well as a decrease in lattice parameter and growth of structure microdeformations. By the deposition process time controlling, 1D metallic NSs with lengths from 3 to 12 μm have been synthesized. The structural and magnetic properties on the NSs dependence on aspect ratio. The growth of length leads to an increase in crystallinity degree, as well as a decrease in lattice parameter and microdeformations. The change in structural parameters is strongly related to stages of nanotubes formation: from the initial defect structure with the smallest crystallinity degree for short nanotubes to polycrystalline low-defect structure for nanotubes of final length (achievement of the pore dimension). Based on the study of magnetic characteristics the presence of magnetic anisotropy in Ni nanotubes has been shown, as well as its nonlinear character dependence on the length. Unique physical, chemical, magnetic and electrical properties of 1D metallic NSs based on elements of iron group (Fe, Co, Ni) as well as Zn and Cu and their alloys cause a great interest in them for a huge range of applications.