Fabrication of porous Co-Pt nanowires and their magnetic properties

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Lately Co-Pt alloy has received considerable attention, because of its unique magnetic properties. – ability to not be affected by superparamagnetism at grain sizes even below 6 nm [1]. These alloys are great candidates for miniaturization of magnetic materials and implementation into magnetic recording devices, micro-electromechanical systems (MEMS). Several techniques have been developed to obtain films, nanowires and other structures of Co-Pt alloy with perpendicular anisotropy. Many techniques focus only on the fabrication of magnetic nanowires – lithography, molecular-beam epitaxy, vapor-liquid-solid growth etc. However, utilization of electrodeposition into nanoporous membranes still is the most widely used technique to fabricate versatile and textured nanowires [2-3].

The aim of this work was to manufacture self-supported Co-Pt porous nanowires using double template method, and investigate their magnetic properties. First of the templates used were anodized aluminum (AAO) membranes with pore diameter of 0.2 μm to form cylindrical nanowires. Second template applied during electrodeposition, which makes growing nanowires porous, was dynamic hydrogen bubble template, when reduction of metal ions occurs in between the hydrogen bubbles. Pulse deposition technique was applied for nanowires fabrication. The influence of cathodic current density, pulse time and its length on the growth of Co-Pt nanowires was investigated. Influence on porosity of three different hydrogen bubbles coalescence suppressant has been investigated, namely ammonium chloride, magnesium sulfate and acetic acid. Effects on nanowires porosity of a surfactant that reduces surface tension, specifically isopropanol, have also been investigated. Obtained nanowires have been studied using XRD, SEM equipped with EDS module, XRF techniques. Magnetic properties of Co-Pt nanowires have been assessed in and out of AAO membranes using VSM magnetometer.

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