Electrochemical Process and Phase Formation of Fe-Based Alloy Nanowires into Anodic Alumina Oxide

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The effect of deposition parameters on the phase formation and composition of Fe-Co alloy nanowires into nanopores of anodic alumina oxide membrane is considered by XRD, FE-SEM, TEM and EDX via electrochemical deposition technique. The deposited alloy nanowires are metastable fcc phase at –4.0 V and at –2.0 V are stable hcp phase. These experimental results can be explained by the classic electrochemical nucleation theory. The formation of fcc crystals can be attributed to smaller critical clusters formed at a higher potential, lower deposition temperature and higher concentration of metal ions during electrochemical deposition process. The content of Fe inside nanowires increases with increasing potential, decreasing deposition temperature and increasing concentration of Fe ions. This can be verified by the polarization curves of depositing Fe and Co nanowires, where the current density ratio of Co to Fe at –2.0 V (0.79) is higher than that at –4.0 V (0.75).

Keywords: Nano cluster; electrochemical deposition; Crystal structure; Scanning electron microscopy; alloy nanowires;

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