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Study of phase transformation of Cobalt nanowires at high cobalt ion concentration prepared through template based deposition

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Among different synthesis techniques electrochemical synthesis of nanowires in anodic aluminium oxide (AAO) template allow control over composition and size of NWs. AAO template are made by anodizing the aluminum foils in oxalic acid (COOH)₂. In this study the phase transformation of Cobalt nanowires was observed at high cobalt ion concentration. The cobalt nanowires was electrochemically deposited in AAO template with direct current (-1.6V) deposition technique using three electrode bath cell. The average pore diameter of nanowires was 50nm which was equal to nanopores in AAO template. XRD results show that using 0.356M solution the hcp Cobalt nanowires were formed at high concentration transformation was occurred. The Fcc Cobalt nanowires were formed at 1.067M solution. The transient (current Vs time) curves display with increasing concentration of Co²⁺ ions, the *i*_{max} increases while the *t*_m decreases. Shorter *t*_m and a higher *i*_{max} value can represent a larger *N*_s (saturation nucleus density). Therefore we believe that the electrochemical deposition at high concentrations of 1.067M at -1.6V could lead to large *N*_s, representing the formation of smaller critical nuclei. The structure of Co can be determined by the critical nucleus size and smaller critical nuclei favour the formation of fcc Co. Therefore the fcc Co nanowires were observed when depositing in the high cobalt concentration solution.