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Deposition of Co3O4 thin films on stainless steel sieves

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Recently Co_3O_4 semiconductor thin films and nanostructures are of great interest for various applications as gas sensors and also for many optoelectronic and photonic applications. Co_3O_4 is usually p-type semiconductor with the spinel crystalline structure and band gap in a suitable range. The possible application of Cobalt (II, III) oxide is as a resistive type humidity and gas (CH_4, H_2, NH_3, CO and NO_2) sensors, catalyst for oxygen evolution and reduction reactions, supercapacitor, solar selective absorber material and pigment for glasses and ceramics. Recently, cobalt oxide films has attracted interest for possible application in the field of optical sensors technology. This work presents comparison of different Co_3O_4 preparation techniques e.g. the direct oxidation in the deposition process, and the thermal separation process of the deposition Co films. A DC magnetron sputtering system with SmCo magnets and 50 mm pure cobalt target was used for the deposition of metallic cobalt films with a good adhesion. These metallic cobalt films were annealed in furnace at elevated temperature transferred on Co_3O_4 films. The further approach of the deposition was the reactive magnetron sputtering of metallic cobalt target in gas mixture of $Ar+O_2$. Different partial pressures of oxygen in the plasma reactor were used and some optimum deposition conditions were found. The substrate temperature during the reactive deposition process was controlled by external heater in the range 300-800 K. The deposition rate of Co_3O_4 films was measured in dependence on oxygen partial pressure, discharge power and the substrate temperature. The deposited Co_3O_4 were further investigated by SEM, XRD, Raman spectroscopy and electrochemistry.

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