Preparation and characterization of Co_3O_4 thin films by the plasma-enhanced atomic layer deposition technique

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Cobalt oxide thin films has been received great attention due to its potential application in various fields such as energy storage, conversion, catalysis and sensors. In general, the cobalt oxide thin films are prepared by wet processes including hydrothermal and plating. However, those techniques are unable to provide high quality of cobalt oxide. To overcome these issues, in present work we prepared the uniform and reproducible cobalt oxide film by the plasma-enhanced atomic layer deposition (ALD) over the silicon substrate (100). The BIS(CYCLOPENTADIENYL)COBALT ($Co(Cp)_2$) is used as the cobalt precursor and O_2 plasma is used as oxidant. In order to prepare uniform and reproducible Co_3O_4 thin film, we have optimized the different parameters such as the precursor pulsing time, Ar purging time, plasma time and others. The maximum growth rate of 0.42 Å per cycle is observed for the Co_3O_4 thin film. The optimized Co_3O_4 thin film further characterized for the physical study to get more information regarding the structure, composition and surface nanostructure of the Co_3O_4 thin film through the XRD, XPS and SEM analysis.