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S. Premlatha, P. Sivasakthi, G.N.K. Ramesh Bapu

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Synthesis of Co-CeO_2 nanoflake arrays and their application to highly sensitive and selective electrochemical sensing of Hydrazine

S.Premlatha, P.Sivasakthi, G.N.K. Ramesh Bapu*

Electroplating and Metal Finishing Technology Division,

CSIR- Central Electrochemical Research Institute,

Karaikudi-630 003 (Tamilnadu) INDIA.

Abstract

A highly sensitive hydrazine sensor was successfully fabricated based on Co-CeO_2 modified nanocomposites by employing a simple, cost effective and versatile electrodeposition technique. The surface morphology and the elemental composition were examined from SEM, FESEM and EDAX analysis. The oxidation states of Co and CeO_2 nanoparticles were characterized using XPS. The crystallite structure and the preferred orientation were analyzed with XRD patterns. FESEM images showed the hierarchical cobalt nanoflakes morphology in which the spherical shaped CeO_2 nanoparticles were embedded over the electrode surface. The electrochemical determination of hydrazine was characterized using cyclic voltammetry and chronoamperometric methods. Interestingly, compared with pure Co, the modified Co-CeO_2 electrode minimizes the overpotential at 0.28 V and largely enhances the oxidation peak current (2.6 mA) for hydrazine electro-oxidation. Amperometric experiments for hydrazine exhibited two linear ranges from 0.005 mM to 0.1 mM and from 0.13 mM to 0.37 mM. In particular the detection limits obtained for the Co-CeO_2 modified electrodes were 6 and 12 nm respectively. The extreme sensitivity and selectivity of the proposed senor material could be due to the porous nature of the material. The analytical parameters revealed that Co-CeO_2 nanocomposites are the promising electrocatalyst for hydrazine sensing.