

Abrasive stripping voltammetric (AbrSV) studies of ErBa₂Cu₃O_{7-δ} superconductor synthesised via co-precipitation and solid state methods

ABSTRACT

The electrochemical analysis of ErBa₂Cu₃O_{7-δ} (ErBCO) superconductor ceramic materials, adhered abrasively at a glassy carbon electrode surface placed in an aqueous media has been investigated by abrasive stripping voltammetry, AbrSV technique. ErBCO samples were prepared via co-precipitation (COP) and solid state (SS) method. Powder x-ray diffraction (XRD) patterns showed both samples to be single-phased 123 of an orthorhombic structure. Details studies on the reduction-oxidation of ErBCO involved the variation of scan rate, temperature and pH of electrolyte as well as chronoamperometry (CA) and chronocoulometry (CC). The voltammogram obtained for ErBCO prepared in both methods showed four major peaks attributed to first and second redox couples. The peaks are due to the redox reaction of Cu(NH₃)₄²⁺ complex. The peak current is highly dependent upon the formation of the Cu(NH₃)₄²⁺ complex which shows that the copper planes in the superconductor played major role in producing the peaks observed in the voltammograms. The voltammetric response of the ErBCO was found to depend greatly on the scan rate, pH and temperature. From CA and CC studies, the amount of charge, Q that was presence on the electrode surface is 4.7 C/cm² and 5.4 C/cm² and diffusion coefficient, D is 3.4 x 10⁻⁶ cm²/s and 4.0 x 10⁻⁶ cm²/s for solid state and co-precipitation method respectively.

Keyword: ErBa₂Cu₃O_{7-δ} ; Abrasive stripping voltammetry; Cu(NH₃)₄²⁺ complex; Chronoamperometry (CA) and chronocoulometry (CC); Diffusion coefficient