Voltammetric Studies of DyBa2Cu3O7-δ (DyBCO) prepared via Solid-state(SS) and co-precipitation (COP) technique.

ABSTRACT

This paper describes a series of electrochemical measurements design to explore the reactivity of the oxide superconductor, DyBa2Cu3O7-δ (DyBCO). The reproducible voltammetry was obtained in the potential window of 1.0 V to -1.0 V vs Ag/AgCl reference electrode. DyBa2Cu3O7-δ was prepared via co-precipitation and conventional solid state technique. Parameters used in this study including the effect of potential cycling, scan rate, temperature and pH as well as chronoamperometry (CA) and chronocoulometry (CC). The electrochemical reduction and oxidation can be recognized easily by the solid-phase voltammetric technique. The cyclic voltammogram for DyBCO prepared in both techniques showed four major peaks attributed to first and second redox couple. 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+ complexwhich shows that the copper planes in the superconductor played major role inproducing the peaks observed in the voltammograms. A complex surface process was found in the redox reaction through the scan rate study. After thorough investigations, it was found out that DyBCO prepared in both techniques responses strongly under acidic(pH ≈ 2.00), high temperature (80oC) condition with slight differences in voltammetricbehaviors. The cyclic voltammetric behavior exhibited by both samples is found to depend greatly on the parameters used in this study. From CA and CC studies, theamount of charge, Q that was presence on the electrode surface is 17.0 µC/cm2 and 25.0µC/cm2 and diffusion coefficient, D is 4.6 x 10-6 cm2/s and 4.0 x 10-6 cm2/s for co-precipitation and conventional solid state technique, respectively. From the chronocoulometry (CC) measurement, the estimated mass of sample that was attachedon the glassy electrode is 65 ng and 96 ng for sample prepared via conventional solid state and co-precipitation technique, respectively.

Keyword: DyBCO; Voltammetric studies; Coprecipitation