Short Communication

Optical and Electrochemical Properties of Silver-doped Yttrium Barium Copper Oxide as High-Temperature Superconducting Materials

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This work focused on electrochemical and optical properties of yttrium barium copper oxide (YBCO) and Ag-doped YBCO (Ag-YBCO) as superconducting films. The films were synthesized through conventional solid state reactions. Morphology, crystal and chemical structure, optical and electrochemical properties of synthesized films were studied at room temperature. Morphological results using FESEM analysis showed that YBCO and Ag-YBCO films surface were covered with rectangular crystal grains which grew parallel and perpendicular to the basal plane. Studying the crystal structure using XRD analysis showed that there was the orthogonal superconducting phase of Y123 before sintering processing. XRD results also showed elimination of BaCO_3 phase and formation of crystalline phase of Ba-Cu-O_3 in sintered YBCO film and incorporation of fcc phase of Ag into the doped film. Raman analysis demonstrated the formation of oxide phases in YBCO and Ag-YBCO films. Optical analysis illustrated the formation of AgO in doped film could provide reactive atomic oxygen to the growth YBCO thin film. Study of electrochemical properties indicated that area specific resistance of Ag-YBCO was lower than YBCO electrode and electrochemical response of Ag-YBCO was more stable than YBCO response because of more electrochemical activity of silver particles of doped film in aqueous solution. Furthermore, Ag addition in YBCO film can change in the charge carrier and electronic structure in the compound due to the formation of oxygen vacancies in the CuO chains or CuO_2 planes. Therefore, the synergetic effect of high electrical conductivity and higher concentration of oxygen vacancy in YBCO and higher stability of silver particles improves the charge transfer and surface oxygen exchange in the electrode, and as a result, it can promote the electrochemical performance of doped film.

Keywords: Electrochemical properties; Silver-doped Yttrium Barium Copper Oxide; Raman spectroscopy; Electrochemical impedance spectroscopy; Cyclic voltammetry

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