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Electrical and Structural Properties of Solid Electrolyte Systems

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Abstract : Samarium (III) oxide and Ytterbium (III) oxide doped Bismuth trioxide solid solutions, the nano ceramic (Bi2O3)1-x-y(Sm2O3)x(Yb2O3)y ternary system were obtained with x=5, 20 mol %, and y=5, 20 mol % dopant concentrations have been synthesized in air atmosphere with solid state reaction. Temperature dependent electrical conductivity of the samples have been investigated by 4-point probe technique by heating and cooling process. Doped-Bi2O3 materials of solid electrolyte systems are good oxygen anions O2-conductors which have collected much attention as potential solid ceramic electrolytes for solid oxide fuel cells (SOFCs) because of their relatively high oxygen ionic conductivity at lower temperatures.(Bi2O3)-based electrolytes have also wide other technological applications in devices with high economical interest such as oxygen sensors, ceramic membranes for oxygen separation, oxygen pumps, catalyzing of some heterogeneous reactions, partial oxidation of the hydrocarbons, and additive material in paints. In recent years, many experimental researches have mostly focused on improving of the Bi-based electrolytes which have high oxide ionic conductivity at low temperatures and better performance as alternatives to traditional stabilized zirconia has taken place. Generally, these systems are much better solid electrolytes than well-known stabilized zirconia, because some of the bismuth trioxide phases exhibit higher ion conductivity than other oxide ionic conductors. Crystal structure of the Nano ceramic (Bi2O3)1-x-y(Sm2O3)x(Yb2O3)y has been determined by X-Ray powder diffractions (XRD) measurements before and after electrical conductivity measurements of the samples. Surface and grain structure properties of the samples were determined by SEM analysis. The samples which synthesized in this study can be used in industrial applications such as electrolytes of the solid oxide fuel cells (SOFC).

Keywords : 4-point probe technique, bismuth trioxide, solid state reaction, solid oxide fuel cell
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