SYNTHESIS AND INVESTIGATION OF THE MAGNETIC PROPERTIES OF Bi2O3 ELECTROLYTES DOPED WITH RARE EARTH OXIDES, CeO2, Ho2O3 and Tb4O7

Mehtap Arıkan PAYVEREN

Erciyes Üniversitesi, Fen Bilimleri Enstitüsü, Fizik, Kayseri, Türkiye

 ORCID ID: 0000–0002–8037–4904

Enis SERT

Çankırı Karatekin Üniversitesi, Fen Fakültesi, Fizik Bölümü, Kayseri, Türkiye

ORCID ID: 0000-0002-7762-4941

**ABSTRACT**

In this investigation, we conducted the synthesis and magnetic analysis of stabilized systems comprising Bi2O3–solid electrolyte, with a specific focus on their suitability for Intermediate-Temperature Solid Oxide Fuel Cells (IT–SOFCs). The face-centered cubic structure inherent to pure Bi2O3 crystals is recognized for its distinctive oxygen ion conductivity. Nevertheless, the super-ion conductor phase within this structure is known to have limited stability within a narrow temperature range, necessitating stabilization for consideration in SOFC applications. For the stability assessment, dopants such as Ce–Ho–Tb rare earth elements were incorporated, and all formulations were synthesized through solid-state reactions conducted at room temperature. To achieve optimal phase stability, the resulting samples underwent annealing at 750 °C for a duration of 100 hours. Magnetic properties of the annealed samples were investigated by Vibrating Sample Magnetometer (VSM) module of the physical properties measurement system (PPMS-Quantum Design). Magnetization vs. temperature (M-T) assessments were conducted across a temperature spectrum of 10-310 K under a 500 Oe applied field. Additionally, magnetic-field-dependent magnetization (M-H) measurements were performed at 10 K and room temperature (300 K), encompassing an applied magnetic-field range of ±2 T for constant temperature evaluations. M-T measurement results revealed the paramagnetic nature of all samples. Both the M-T and the M-H measurements at low temperature showed that the increasing doping rate of Ce and Tb resulted in increasing magnetization.

**Keywords**: Bi2O3–solid electrolyte, Solid oxide fuel cell, Magnetic Properties

**References:**

**1**. M.A. Azizi, J. Brouwer. Progress in solid oxide fuel cell–gas turbine hybrid power systems: System design and analysis, transient operation, controls and optimization. Appl. Energy., 215 (2018), pp. 237–289.

**2**. M. Singh, D. Zappa, E. Comini Solid oxide fuel cell: Decade of progress, future perspectives and challenges Int. J. Hydrog., 46 (2021), pp, 27643–27674.

**3**. E. D. Wachsman, K.T. Lee. Lowering the Temperature of Solid Oxide Fuel Cells. Science, 334 (2011), pp, 935–939.

**4**. Z. Zakaria, S. H.A. Hassan, N. Shaari, et al.. A review on recent status and challenges of yttria stabilized zirconia modification to lowering the temperature of solid oxide fuel cells operation. Int. J. Energy Res., 44 (2020), pp, 631–650.

**5**. N. Mahato, A. Banerjee, A. Gupta, et al. Progress in material selection for solid oxide fuel cell technology: A review. Prog. Mater. Sci., 72 (2015), pp. 141–337.