RECYCLING OF COMPONENTS OF WASTED SOLID OXIDE ELECTROLYSERS OR FUEL CELLS

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Summary: Decarbonized hydrogen production is expected to play a key role in the transition to a sustainable fossil free economy [1]. However, high demand for carbon free hydrogen requires large size Solid Oxide Electrolyzers (SOEs) which in turn have economic, environmental and legislative problems of end of life products [2]. To solve this problem, we are attempting a strategy to recycle and reuse Solid Oxide Cells (SOCs) components and regenerate electrolytes. The separation of electrode-electrolyte assembly was performed through mechanical scratching and grinding followed by thermal and chemical treatments. Recycle materials of SOFCs components; air electrodes ($La_xSr_{1-x}CoO_3$), nickel oxide (NiO) which constitutes about 50% in weight of the cell and Yttria Stabilized Zirconia (YSZ) were successfully obtained. Detailed crystallographic studies, microstructure, and compositions of the recovered materials were studied respectively by X-Ray Diffraction and Scanning Electron Microscope/Energy Dispersive X-Ray Spectroscopy. The electrical conductivity of the recycled electrolyte pellets was measured in air by Electrochemical Impedance Spectroscopy from 250°C to 715°C. The conductivity of the electrolyte made from recycled materials of SOCs wastes was compared with different composition of commercial YSZ materials [3-5]. A total electrolyte conductivity of 4.8x10-3Scm^{-1} was measured at 700°C. The lower level of conductivity of the regenerated electrolyte material is discussed and improvements to increase it are suggested.

Reference

[1] Hosseini, S.E., Wahid, M.A., Renew. Sustain. Energy Rev, **2016**, vol 57, 850-866

[2] Wright, E.I, Clegg A. J and Rahimifard S., J., Power Sources, **2009**, vol 190, 362-371

[3] Mæland, D, Suciu, C., Waernhus, I., Hoffmann, A.C., Eur. Ceram, **2009**, vol. 29, pp. 2537-2547

[4] Zhang, J., Lenser, C., Menzler, N.H., Guillon, O., Solid State Ion, **2020**, vol 344, 115138-115148

[5] Badwal, S. Solid State Ion **1992**, 52 (1–3), 23–32.