

VARIATION OF YTTRIA CONCENTRATION IN STABILIZED ZIRCONIA MICROTUBES FOR HIGH TEMPERATURE FUEL CELL APPLICATION

Andreas Nõlvak¹, Gunnar Nurk², Aile Tamm¹, Tanel Tätte¹

¹*Institute of Physics, University of Tartu, W.Ostwaldi 1, 50411 Tartu, Estonia*

²*Institute of Chemistry, University of Tartu, Ravila 14a, 50411 Tartu, Estonia*

e-mail of presenting author: andreas.nolvak@ut.ee

The application of microtubular geometry brings about multiple enhancements of high temperature solid oxide electrolyte systems. Microtubular solid oxide fuel cells, in comparison to macroscale planar cells, are more durable to thermal cycling with a shorter startup time and higher power density [1, 2]. Consequently, new approaches to miniaturize fuel cells have gained considerable attention [3].

In this study, the preparation of stabilized zirconia microtubes (outer diameter <100 µm; wall thickness averaging 10 µm) and their ionic conductivity dependence on yttria dopant concentration (0.96, 1.59, 2.52 and 3.73 mol%) was investigated. On the basis of literature, it can be outlined that previously investigated smallest structures have been more than one order of magnitude larger with outer diameters staying in the 1 mm range [2]. The method for synthesizing novel microtubular ceramic structures is described in previous works by our group [4, 5] along with a patent held by University of Tartu.

Microtubes with dopant concentrations of 2.52 and 3.73 mol% were successfully fabricated. Ionic conductivities of 0.008 and 0.013 S/cm at 950 °C were calculated from electrochemical impedance spectroscopy (EIS) data for microtubes with 2.52 and 3.73 mol% dopant concentration, respectively. Microstructure of the tubes was characterized using HR-SEM, TOF-SIMS, XRF.

References:

1. K. S. Howe et al, J. Power Sources, vol. 196, no. 4, pp. 1677-1686, 2011.
2. V. Lawlor, J. Power Sources, vol. 240, pp. 421-441, 2013.
3. V. Lawlor et al., J. Power Sources, vol. 193, no. 2, pp. 387-399, 2009.
4. M. Part et al., RSC Adv., vol. 4, no. 24 pp. 12545-12554, 2014.
5. T. Tätte et al., RSC Adv., vol. 4, no. 34, pp. 17413-17419, 2014.



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