# Samario oksidu modifikuotų cerio oksido nanomiltelių, gautų išdeginimo sintezės metu, fizikinių savybių tyrimai

# Synthesis and properties of samaria-doped ceria nanopowders prepared by glycine nitrate combustion method

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Miniaturized solid oxide fuel cells (μ-SOFCs), constructed using thin film methods can achieve high specific energy and energy density and may partially replace Li batteries in portable devices [1,2,3]. However, the initial materials used in the fabrication of μ-SOFC process should fully satisfy the requirements. Recently, the thickness of the μ-SOFC three-layered structure (anode-electrolyte-cathode) has been reduced to one micron size. Thus, the thickness of electrolyte thin film in μ-SOFC becomes much thinner, e.g. ~ 600 nm, compared to conventional SOFC. The reduced thickness can minimize the ionic transport path and significantly reduce ohmic resistance [4]. The properties of μ-SOFC electrolyte thin films strongly depend on the initial materials and their characteristics, therefore the choice of synthesis method, processing stages and conditions are particularly important. Samaria-doped ceria (SDC) has widely used in various solid oxide fuel cells (SOFCs) as electrolyte, fossil fuel technology, for gas sensing devices and in automobile exhaust systems.

In this work, samaria-doped ceria ($Ce_{0.8}Sm_{0.2}O_{1.9}$) powders were prepared by a glycine nitrate combustion method, and developed for intermediate-temperature solid oxide fuel cells (IT-SOFCs). Despite the large variety of methods to synthesize SDC powders, including Pechini, sol-gel, co-precipitation techniques, polyol method, glycine combustion method attracts a lot of attention due to low cost and simplicity of the technique in comparison of other fuels.

The thermal decomposition of the synthesized powders was investigated by the thermogravimetric (TG) and differential thermal (DTA) analysis. The microstructural and morphological properties of nano-sized samaria-doped ceria were studied by X-ray diffraction (XRD), scanning electron microscopy (SEM) techniques, and Brunauer-Emmet-Teller (BET) surface analysis. The thermal analysis together with XRD results demonstrate the effectiveness of the glycine combustion process for the synthesis of pure phase nanocrystalline powders. The AC conductivity of sintered pellets (pellets were sintered at 1200°C for 2h) was observed by two-probe impedance spectroscopy in the temperature range of 200-800 °C, and from 1 Hz to 3 MHz frequencies. Plasma sputtering technique with platinum target was used onto either side of the sintered, cut and polished SDC pellets to serve as an electrode.

XRD analysis data of synthesized powders clearly indicates the formation of a single-phase SDC with cubic crystal structure. Thus for the preparation of SDC ceramic powders the suggested glycine nitrate combustion synthesis method is suitable. As a result, SDC powders possess ionic conductivity in which conductivity plots show correspondence of grain interior, grain boundary and polarization of platinum electrode in sequence of decreasing frequency. At higher temperature, two semicircles which correspond to grain boundary and grain interior disappear causing that only processes due to electrode may appear.

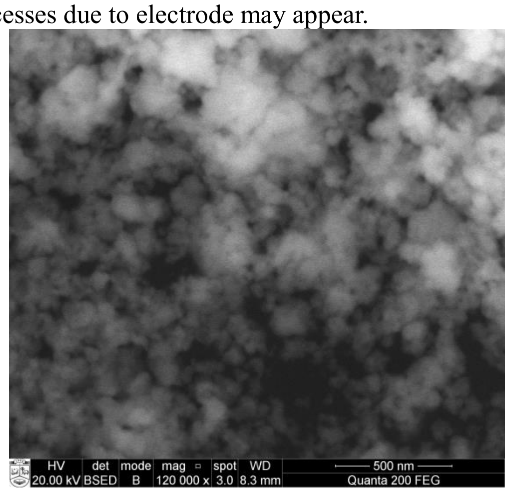


Fig. 1. SEM micrograph of SDC nanopowders

*Keywords: solid oxide fuel cells, samaria-doped ceria, combustion.*

## References

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