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DEPOSITION OF SAMARIA-DOPED CERIA FILM BY ULTRASONIC SPRAY PYROLYSIS METHOD

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A solid oxide fuel cell (SOFC) is an efficient energy conversion device that produces electricity based on electrochemical reactions. One of the main components in SOFC system is a dense oxide ion conductive electrolyte membrane, placed between porous anode and cathode. Samaria- or gadolinia- doped ceria has been considered as promising SOFC electrolyte due to high ionic conductivity at intermediate temperatures [1]. For proper work of SOFC, dense and gastight electrolyte membrane layer is needed. Gastight ceria film can be obtained by several methods, as screen-printing or tape casting, but thermal treatment at very high temperatures is then required. Spray methods have advantages from this point of view. As it is demonstrated by Gauckler et al. [2], the deposits made by spray pyrolysis could be sintered at low temperatures as 1000°C. In this work samaria-doped ceria film with thickness of 1.5 µm was deposited on yttria-stabilized zirconia substrate by ultrasonic spray pyrolysis method. Based on previous works in the field of spray pyrolysis, the mechanism of film formation was additionally studied. Metal nitrates in a tetraethylene glycol-based solvent was used as precursor solution in the ceria layer deposition process. The film was formed from ring- and disc-shaped deposits. The morphologies of single deposits and the film structure were influenced by the parameters like deposition temperature, solvent type, carrier gas pressure and spraying distance. Based on the thermal analysis data obtained, the deposition temperature was optimised in order to ensure the decomposition of nitrate precursors and to obtain oxide phase in the as-deposited film. The film was annealed at temperature 1000°C for 1 h. Some cracks were observed in the film deposited. Therefore fine-tuning of deposition conditions are required in order to obtain the crack-free homogenous film. On the next stage of this study the conductivities of the films will be measured by varying dopant concentration and deposition parameters.

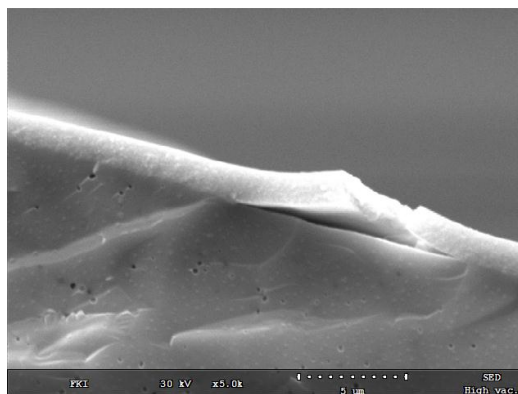


Fig.1. Samaria-doped ceria film deposited on yttria-stabilized zirconia substrate by ultrasonic spray pyrolysis method.

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References

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