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Synthesis of $BaZr_{0.8}Y_{0.2}O_{3\pm\delta}$ dense electrolyte for methanol production at co-ionic electrochemical membrane reactors

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A novel process for methanol synthesis at atmospheric pressure from CO_2 and H_2O through the use of co-ionic conducting ceramic Electrochemical Membrane Reactors (EMRs) is under research. These reactors require materials with sufficient ionic conductivity. Three different preparation methods are applied (Solid State method-SS, Auto Combustion-AC and Spray Pyrolysis-SP) in order to produce a suitable single phase electrolyte materials. The target has been to optimize the preparation procedure towards a pure $BaZr_{0.8}Y_{0.2}O_{3\pm\delta}$ (BZY) as well as its shaping into dense electrolyte disks/membranes of 1-2mm thickness. In SS method researchers report a persistent impurity phase of Y_2O_3 in final oxide. However after firing at 1450°C/14h in the presence of a sintering agent, dense structures are prepared. The production protocol applied in this research eliminates the impurity phase prior sintering providing a material of pure perovskite phase for further powder processing. A multistep firing protocol is proposed with ball milling intervals. Two intermediate thermal steps at 600°Cand 900°C, ball milling and thermal treatment at 1300°C are applied. On the other hand AC method (cations to citric acid equal to 1:1.5 molar ratio) is successfully applied. Random shaped particles (~7μm) of pure perovskite phase are successfully prepared. Furthermore SP produces cubic like particles even from 500°C. Firing up to 1200°C or 1300°C develops single-phase BZY while the cubic morphology of the primary particles is maintained (~2 μm edge). All the above are verified by XRD, SEM and particle size distribution analysis whilst dense electrolyte pellets are successfully produced with >93% relative density.

Biography

V Stathopoulos has BSc Chemistry, PhD Physical Chemistry, and Postdoctoral studies from Johannes Gutenberg Univeristat Mainz, Germany. He is the head of Laboratory of Chemistry and Materials Technology, Technological Educational Institute of Sterea Ellada, Greece. His research is focused on oxide ceramics with environmental and energy applications incl. catalysis. He is the coordinator of an EU project (12 partners/8 countries) and well experienced in the management of projects for the private and academic sector. He is author of over 25 scientific publications, >90 conference presentations and several technical papers in the private sector.

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