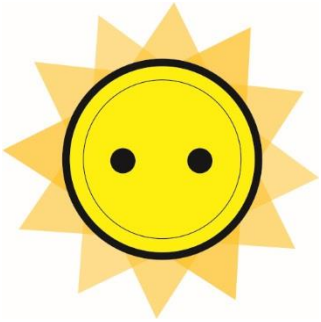

Multi-Functional Nanocomposite Materials for Low-temperature Ceramic Fuel Cells

Fuel cell technology has a tremendous potential for sustainable clean energy production. Among various types of fuel cell, solid oxide fuel cells (SOFC) are known as one of the most promising fuel cell technologies. However, their commercialization is hindered due to a very high operation temperature (>800 ^{o}C) which causes several problems including materials degradation, sealing issues, long start-up time and high cost. Fortunately the operating temperature can be reduced to (300-600 ^{o}C) by using nanocomposite ceramic materials such as ceria based composites. To accomplish high performance and durability at such lower temperatures, novel materials and robust fabrication methods need to be employed with improved material characterization, device modelling and testing. Most important challenge is limited ionic conductivity of the electrolyte of a fuel cell. To improve the ionic conductivity of the electrolyte, hybrid electrolytes consisting of doped ceria and alkali metals (Li, K, Na) eutectic carbonates are used. Though the usage of molten carbonates significantly improve the ionic conductivity of the electrolyte, it is essential that all the electrode materials remain stable without detrimentally reacting with the corrosive hybrid electrolyte. Furthermore, the anode (NiO-ceria cermet) and cathode materials (perovskites structured composite materials) need to be optimized to reduce the losses in the device. Therefore, it is inevitable to understand the transport and reaction mechanisms in the fuel cell. This can only be achieved by performing a systematic study.

New Energy technologies group at Aalto University and other project partners (IIT-India, CGRI-India, UA-Portugal, UiO-Norway and VSS-Turkey) are committed to solve the current research challenges by combining both academic and industrial sectors in EU and India, and establishing strong scientific links and employing effectively trans-national resources. All the partners in this project have extensive experience and competence in fuel cells, solid-oxide ionic conduction materials, nanomaterials and different aspects involved in these fields. This project brings together necessary multi-disciplinary expertise on nanomaterials, electrochemistry and material science. Success of this project would lead to a technology breakthrough.

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