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Synthesis and characterization of nanomaterials for solid oxide fuel cells

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Introduction & Aim: Solid oxide fuel cells (SOFCs) are a class of fuel cells characterized by the use of a solid material as the electrolyte. SOFCs use a solid electrolyte to conduct negative oxygen ions from the cathode to the anode. The electrochemical oxidation of the oxygen ions with hydrogen or carbon monoxide thus occurs on the anode side. The purpose of this presentation is to discuss the synthesis and characterization methods of nanomaterials for electrolytes in solid oxide fuel cells.

Synthesis: One of the efficient methods for the synthesis of nano particles is the modified combustion technique. In this method, stoichiometric amounts of chemicals are made in to a solution and heated. The solution boils and undergoes dehydration followed by decomposition leading to a smooth deflation producing foam. On persistent heating, the foam gets auto-ignited due to self-propagating combustion, giving a voluminous fluffy nanopowder. The obtained powder is annealed in oxygen atmosphere below 700°C to eliminate the trace amount of organic impurity that may remain in the sample.

Characterization: Structure of the as-prepared powder can be identified by the powder X-ray diffraction (XRD) technique and the particle size using transmission electron microscopy. The powder can be pressed into disc pellets of thickness 2 mm using a hydraulic press with a pressure of 100 MPa, and then sintered at optimized temperatures. The surface morphology of the sample is analyzed using scanning electron microscopy (SEM). The impedance spectroscopic study is carried out by making the pellet in the form of a disc capacitor.

Conclusion & Significance: The impedance spectroscopic studies establish the feasibility of the materials to use as an electrolyte in SOFCs.

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An analysis of barriers for minimizing embedded energy in the construction materials

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Rapid increase of population, and consumer demand increased. As a result, production has increased to meet the consumer demand while operate in the competitive market. At the production stage of brick manufacturing, it is a requirement SMEs to consider the impact to the environment. It is necessary to protect the natural environment for the purpose of organism preservation and conservation. Therefore it is essential to accelerate transition to generate long term dramatic carbon footprint mitigation measures during production process through the control of embodied energy which is a determining factor. Small and Medium Scale Enterprises have still not considered significance of reduction of usage of energy. Researchers identified consumption of energy being largely associated with the manufacturing process, reduction of embedded energy and emissions are extraordinarily connected to productivity of kW/H of energy consumption. In order to carry out research goal of implementing barriers of reduction of embedded energy usage in bricks, responses to thirty five questionnaires were collected from brick manufacturing SMEs registered under the Ministry of Industry and Commerce, Sri Lanka. Five unstructured interviews were conducted with relevant professionals in order to ascertain their opinion. These findings can be used as residue of the research process for the development of reduction of embodied energy consumption during production process. Implementation model of embodied energy usage minimizing which is based on the balance scorecard framework to acceleration transition can be used for policy makers to re-think their planning. These findings could directly benefit any country where bricks manufacture for construction purposes is being put into practice; in order to identify factors that would minimize global warming potentials of brick manufacturing SMEs, while gaining return to the SMEs, providing benefit to the society and to the environment at large through sustainable production.

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