Development of SOFC Button Cell in UiTM

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Our Physics Chemistry Material Research Group (PCMaG) is actively studying and developing electrolyte, cathode and anode materials with encouraging results. Thus, the findings has motivated us to further explore the performance of these electrolytes, cathode and anode in the anode supported button cell for H^+SOFC. From our previous project, a work on fabricating electrolyte supported half cell using LSCO, LSCF, composite LSCF-BZCY, NiO-BCZY and Pt was carried out. This work includes the research on synthesizing electrolyte, cathode and anode materials using wet chemical methods as well as the characterization of the fabricated half cell using impedance spectroscopy to obtain the area specific resistance, activation energy and charge transport number. Kinetic study at cathode and anode functional layers was also done. Electromotive force (emf) value of the system was measured using several types of concentration cells. Results indicated that this half cell demonstrated an area specific resistance of up to 0.97 ohm cm^2 , a high conductivity up to 10^{-3} Scm^{-1} and proton conductor (t_{H+}= 0.78) at T=600 ^oC. Also, the excellent performance can be attributed to the structures, microstructure and the intrinsic conductivity as a results of modification and tailoring the properties of materials and fabricated cell using chemistry techniques. The electrolyte material also chemically and mechanically stable towards water vapour and carbon dioxide atmospheres. It is suggested that other than the successful fabrication of the half cell, the excellent performance can be attributed to the porous structures of cathode and anode materials. Furthermore, we are also successfully prepared the dense thick film of submicron grain electrolyte by slowing down the grain growth at minimum sintering time and temperature. From this work, the potential of porous electrode (anode and cathode) and dense electrolyte for industrialization can be further explored by other material scientists and/or electrochemical devices related researchers.