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Pb-doped Bismuth Oxide Electrolyte Materials for Intermediate Temperature Solid Oxide Fuel Cells

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Fuel cells provide a way to convert chemical energy into electrical energy. The electrolyte used is one of the components that can be optimized to enhance the operation of the fuel cell. There are different types of electrolytes with the most common electrolyte used being yttrium stabilized zirconia. This work focuses on using doped bismuth oxide as an electrolyte due to its extremely high conductivity in its face centered cubic(fcc) structure while using specific dopants in a triple doped system(Y3+, Ce4+ and Pb2+) to promote certain characteristics with particular focus on Pb2+ for increasing conductivity. Variable Temperature electrochemical impedance spectroscopy (EIS) and Powder x-ray diffraction (PXRD) were both used to determine the conductivity performance and structural stability. It was revealed that increasing the Pb2+ concentration of the system, while fixing the concentration of the other dopants, resulted in increased conductivity. The linearity of both samples on the Arrhenius plots showed that there was not any major phase change. However, it seems that at higher temperatures, lead migrates away from the cubic structure which was revealed with VT-PXRD as the diffraction pattern showed a degradation of the cubic structure and discolouration of sample.

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