Optimisation of Ionic Conductivity in Intermediate Temperature Solid Oxide Fuel Cells

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The growing concern for the environment, coupled with the depletion of the world's supply of fossil fuels, has caused much interest in finding new sources of energy production which are both environmentally friendly and sustainable. Solid Oxide Fuel Cells (SOFCs) have emerged as a promising candidate for the future of energy production, using a wide range of fuels (H_2, CH_3OH, CH_4 etc). SOFCs can convert fuel directly into electricity and heat through an efficient electro-mechanical process with little or no pollution (depending on the fuel used).

Materials with the fluorite structure have been found to provide sufficient ionic conductivity for use as the electrolytes in SOFCs. However current technology, such as yttria-stabilized zirconia, requires operating temperatures over 800°C before sufficient conductivity is achieved. It is important to find alternative electrolytes that have sufficient conductivity at intermediate temperatures (400-800°C) as this will eliminate problems with high temperature SOFCs such as mechanical stress and allow the SOFC to be constructed from cheaper materials. To this end we will be investigating the ionic conductivity of possible electrolytes such as Bi_2O_3, CeO_2, $LaGaO_3$, $La_2Mo_2O_9$, La_2FeAlO_5 and $Sr_3Ti_2O_7$.