Synthesis and characterization of lanthanum germinate apatite \( \text{La}_{9.33}\text{Ge}_6\text{O}_{26} \) by molten-salt route as electrolytes for solid oxide fuel cells

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Solid oxide fuel cells (SOFCs) are attracting considerable attention as high efficiency environmentally friendly energy systems, and are seen as an important technology for reducing our greenhouse gas emissions. The conventional SOFC electrolyte material is yttria-stabilised-zirconia (YSZ), requiring very high operating temperatures of about 1000 °C to achieve sufficient oxide-ion conductivity, which is disadvantageous for the SOFC life time and options of inexpensive interconnect materials. There is, therefore, considerable interest in reducing the operating temperature down to 800 °C.

Apatite-type lanthanum germinates are successfully synthesized by facile molten-salt method, using NaCl as eutectic salt. The obtained \( \text{La}_{9.33}\text{Ge}_6\text{O}_{26} \) powders are homogeneous, nano-size, less agglomerated and well crystallized. Furthermore, the proper pellets have been prepared at a relatively lower sintering temperature of 1100 °C. The ionic conductivity reaches a value of \( 1.2\times10^{-2} \text{ S cm}^{-1} \) at 750 °C, which is comparable to the samples sintered at high temperature by the conventional methods. In addition, the related mechanism is also discussed.