THE EFFECTS OF EXCESS SODIUM, SINTERING AND SAMPLING PARAMETERS ON IONIC CONDUCTIVITY OF ZINC STABILIZED β”-ALUMINA

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ABSTRACT

Sodium β”-alumina is used in batteries due to its high ionic conductivity. This work studied the effect of excess sodium on the grain size, sintering behavior, and ionic conductivity of zinc stabilized β”-alumina. Two compositions, each with varying amounts of excess sodium (molar Na/Al = 0.01 &0.02), were synthesized and sintered at varying temperatures and times(1610 °C, 1625 °C and 1640°C; 30 minutes and 1 hour). It was found that grain size and density had the largest influence on ionic resistivity in the materials and that the presence of increased sodium in the composition did not aid in sintering or decrease ionic resistivity.

Which factors affect AC impedance spectroscopy, used to measure ionic conductivity in these materials, is not fully understood. The effects of sample thickness and electrode material were evaluated to determine the repeatability of data across these parameters. A connection between these factors was established. Resistivity was determined to be independent of sample thickness; although thinner samples exhibited greater uncertainty in collected data. Additionally, it was determined that of the choice of electrode material did influence collected data. Resistivity and activation energy for samples measured using gold and fluxed platinum electrode could be directly compared to each other, whereas the data collected using unfluxed platinum and carbon electrodes could not; showing that electrode material did affect impedance spectroscopy measurements.