Ceramics and Energy: State of the Art in Cathode Materials for SOFC

Aligül Büyükaksoy [1]

[1]Department of Materials Science and Engineering, Gebze Technical University, Kocaeli/Turkey

The growing world population and the widespread use of personal technological devices cause an increase in the world's energy demand. This demand has been met by the combustion of fossil fuels, which result in the fast depletion of limited fuel resources and enhanced carbonaceous gas emissions that are harmful for human health. Solid oxide fuel cells (SOFCs) are ceramic membrane-based energy conversion devices that can operate either on hydrogen or hydrocarbon fuel gases with efficiencies reaching 80%. This renders them promising alternatives to the conventional energy conversion routes. However, SOFCs are yet to become a commercial success, due to the high cost per power they offer and the long-term instability they exhibit at the operating temperatures of 800 – 1000 °C. These issues can be resolved by obtaining high specific powder density from SOFCs and, if possible, achieving this goal at low operating temperatures (e.g., ≤700 °C).

To develop SOFC cathodes that can exhibit high ORR activity, three different approaches of research have been adopted; pursuit of *i)* mechanistic understanding that would later allow the development of new strategies for cathode development, *ii)* novel cathode material chemistries that exhibit high electrocatalytic activity or *iii)* new fabrication methods that would yield desirable microstructures and thus, high electrochemical performance. In this talk, along with a brief literature review, the research of our group at Gebze Technical University on the development of novel SOFC cathode fabrication methods and the microstructure-electrochemical performance relationship they yield will be presented. More specifically, fabrication of single-phase mixed ionic electronic conductor (MIEC) perovskite and perovskite-ionic conductor composite thin film cathodes by polymeric precursor-based methods and the resulting properties will be the focus.

Aligül Büyükaksoy E-mail Address: aligul@gtu.edu.tr