High-temperature Electrochemical Systems for Clean Energy Production

Duy Pham
Kennesaw State University

Mohamed Elkholy
Kennesaw State University

High-temperature Electrochemical Systems for Clean Energy Production

Duy Pham[1], Jared Malbrough[2], Mohammed Elkholy[1], Quang Lam[1], and Ashish Aphale[1*]

[1] Department of Mechanical Engineering, Kennesaw State University, Marietta, GA

[2] Department of Mechanical Engineering Technology, Kennesaw State University, Marietta, GA

Abstract

With the depletion of fossil fuels and increase in carbon emissions, power generation using clean energy technology remains a major research thrust today. High temperature electrochemical systems such as solid oxide fuel cells (SOFC) are upcoming energy conversion systems with advantages of fuel flexibility, high efficiency, and cost effectiveness. Our research at KSU focuses on the development of a fundamental understanding of various surface and interfacial degradation modes in fuel cells. This study will highlight ongoing research from both the computational and experimental work and the fundamental working principle of SOFC will be presented. Simulation data pertaining to the structural stability of fuel cells under thermal gradient and cycling conditions will be discussed. Experimental results of fabrication of laboratory scale single fuel cell will be highlighted, and performance matrix will be discussed. Results from high-temperature oxidation and measurement of electrical conductivity at elevated temperatures on stainless steel samples will also be discussed. SOFC power systems find numerous applications in automotive, residential power grids, industrial power plants, and in mission-critical projects.