Abstract #750, 224th ECS Meeting, © 2013 The Electrochemical Society

Fundamental investigation of hydrogen transport in ferritic stainless steel for S.O.F.C. interconnect applications

C. Zimny, R. Amendola, P. Gannon, C. Berry

Montana State University
421 Roberts Hall
Bozeman, MT 59717-3920 USA

Ferritic stainless steel (FSS) is widely used for interconnects in planar solid oxide fuel cell (SOFC) stacks. Interconnects separate and connect individual cells into a stack. This design demands the interconnect to be simultaneously subjected to high temperature (800°C), moist oxidizing (air) conditions on the cathode side, and moist reducing conditions (H_2) on the anode side, creating a "dual atmosphere exposure."

It is generally accepted that, at high temperatures, hydrogen transport through the steel promotes accelerated and/or anomalous corrosion.

It is hypothesized that effective hydrogen transport through steels can be dominated by hydrogen-soluble, interconnected grain boundary precipitates or by the presence of surface layers.

This investigation focuses on evaluating these hypotheses via parametric studies of steel compositions (and microstructures), sample thicknesses, and hydrogen partial pressures within customized dual atmosphere exposures (in terms of temperature and time) to elucidate and model mechanisms governing hydrogen transport in steels.

Resulting observations, along with speculated mechanisms, will be presented and discussed in the context of facilitating engineering of steels and protective coatings to develop durable interconnects for long-term, high-performance SOFC systems.