BIOGRAPHICAL SKETCH

Yutian Yu was born in Jiangxi Province, China. He entered Nanchang Hangkong University in September 2010 and received the Bachelor degree in Mechanical Engineering in June 2014. In August of 2014, he was accepted into the Ph.D. program at Tennessee Tech University. His current interests are the interconnect coating and cathode-side contact layer for solid oxide fuel cell application. He expects to complete his doctoral program in May 2020.

EDUCATION

Ph.D. Engineering
Tennessee Tech University, 2014-Present

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College of Engineering

TENNESSEE TECH

The Department of

Mechanical Engineering

Announces the Dissertation Defense of

Yutian Yu

In Partial Fulfillment of the Requirements

For the degree of

Doctor of Philosophy in Engineering

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Held in

Brown Hall Room 315

Tennessee Tech University

Zoom Link:
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FIELD OF STUDY

Mechanical Engineering

DISSERTATION TOPIC

THE PERFORMANCE OF SPINEL-BASED INTERCONNECT COATING AND CATHODE-SIDE CONTACT LAYER FOR SOLID OXIDE FUEL CELL APPLICATION

EXAMINING COMMITTEE

Dr. Jiahong Zhu (Chairperson)

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Dr. Yung-way Liu

ABSTRACT

The development of low-cost raw materials and process for achieving high-quality cathode-side interconnect coating and contact layer is critical to the commercial deployment of solid oxide fuel cell. The transitional metal-containing spinels are widely used as coating materials for protecting ferritic stainless steel interconnects. This study focuses on developing a cost-effective approach to achieve high-performance interconnect coatings and investigating spinel-based materials to replace conventional perovskite contact at the cathode-interconnect interface. A mixture of Fe+CoO or Co+Mn_3O_4 is applied on the interconnect via screen printing and then thermally converted into a dense and adherent spinel layer in air at the elevated temperature. The synthesized layers inhibit the Cr_2O_3 scale growth on the stainless steel and reduce the scale area-specific resistance. When commercial reactive element-free alloys are used as the interconnect, Ce element can be readily added into the spinel, further improving the behavior of the interconnect/coating system. A variety of spinel-based contact layers are synthesized with different precursors and evaluated with regard to the electrical performance and microstructural evolution. The metal-containing precursor layers are fully converted after the sintering in air due to the enhanced sinterability. It is observed that the contact layer derived from the alloy precursor is more uniform in microstructure and composition due to the shorter diffusion distance. Also, with the use of two optimal spinel-forming precursors, a dual-layer structure with a dense protective coating layer and a porous contact layer can be formed simultaneously at the stack firing temperature without the need of any reduction treatment, further simplifying the cell assembling process and thus reducing the overall fabrication cost.