

Challenges in the Development of Stainless Steels for SOFC Interconnect Application

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Abstract:

Solid Oxide Fuel Cells (SOFCs) is one of the promising electrochemical devices used to convert chemical to electrical energy. Materials used as components in the SOFCs must be durable in cathode (oxygen or humidified oxygen) and anode (fuel) atmospheres at high temperatures of about 800 °C or lower [1,2]. At these temperatures, stainless steel has potential to be used as an interconnect, a part that separates the cathode gas from the anode one. This plenary talk will address the progress and challenges in the development of SOFC interconnect stainless steels. The studied materials are bare stainless steels [1,2] and stainless steels with surface modification particularly by pre-oxidation technique [3] and spinel coating [4]. The primarily required property of the steel is its low oxidation rate in SOFC atmospheres e.g. dry and humidified oxygen [1,2], hydrogen [1] and biogas [5], as well as the low area specific resistance of the steel in service [1]. Thermal oxide scale must also be well adhered to the steel substrate to maintain the integrity of interconnect as well as to avoid the infinite increase in electrical resistance due to the presence of air gap between steel and the oxide scale [1]. The adhesion test using the tensile method [6,7] accompanied by the Galerie-Dupeux model for the adhesion energy quantification [6–8] will also be presented. Finally, Cr vaporisation of the Cr-forming stainless steels at high temperatures especially in humidified oxygen has to be avoided to reduce its poisoning effect on the cathode [3,4]. The experimental set-up to measure the Cr vaporisation and the surface modification to reduce this problem [3,4] will also be addressed in the talk.

References

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