Diffusion of Nickel into Ferritic Steel Interconnects of Solid Oxide Fuel/Electrolysis Stacks -
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Stainless steels are used as interconnects in Solid Oxide Fuel Cell/Electrolysis stacks. Their high temperature corrosion resistance has been studied mainly to describe oxide scale formation processes. Other corrosion/degradation processes may also be of relevance to overall life time, for example diffusion of nickel from the Ni/YSZ electrode or the contact layer into the interconnect plate. Such diffusion can cause austenization of the ferritic structure and could possibly alter corrosion properties of the steel. Whereas this process has already been recognized by SOFC stack developers, only a limited number of studies have been devoted to the phenomenon. Here, diffusion of Ni into ferritic Crofer 22 APU steel is studied in a wet hydrogen atmosphere after 250 hours of exposure at 800 °C using Ni-plated (~ 10 micron thick coatings) sheet steel samples as a model system. Even after this relatively short time all the metallic nickel in the coating has reacted and formed solid solutions with iron and chromium. Diffusion of Ni into the steel causes formation of the austenite FCC phase. The microstructure and composition of the oxide scale formed on the sample surface after 250 hours is similar to the one observed with no Ni coating. The results show that over the time studied the overall corrosion rate of the interconnect in wet hydrogen is not affected by the Ni diffusion and formation of the austenitic phase.

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