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Protective coating for current collector materials of direct liquid fuelled molten carbonate fuel cell

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Due to the growing problem of global warming, molten carbonate fuel cells (MCFCs) are considered a promising technology for producing clean energy from hydrogen and various fuels such as natural gas, biogas and syngas. MCFCs have a high efficiency of up to 60% and do not produce pollutants, which makes them an attractive alternative to conventional energy generation methods. The MCFCs powered directly by liquid hydrocarbon fuels is an alternative to power generators based on internal combustion engines or gas turbines, desirable for applications away from fixed electricity sources and the fuel grid, as well as for other portable applications.

One of the main challenges is the degradation of MCFC components. The review of the literature shows that one of the main sources of MCFC degradation, which affects the performance and durability of fuel cells, is the corrosion of MCFC parts, mainly current collectors and interconnectors/bipolar plates. Interconnects/bipolar plates provide the supply of the operating gas environment and current transportation in fuel cell stacks. As materials for interconnects, highly alloyed steels, with oxidation resistant and electrically conductive coatings based on spinel or perovskite are traditionally used. One of the methods of protecting and improving the corrosion properties of steels is the application of coatings based on nitrides.

The aim of the work is to study the service properties of thin (0.5 mm) stainless steel interconnects with nanostructured coatings of the Cr-N, Cr-Ti-N and Ti-Al-Gd-N systems at 600C in the air.

The coatings were deposited on polished 304L stainless steel specimens using a Cr, Ti-Al, Ti-Al-Gd cathode and the vacuum arc method. Oxidation resistance and electrical conductivity of coatings after long-term (1000 h) holding at 600°C in air were studied. Electrical conductivity of obtained coating was $1.7...3.5 \cdot 10^5$ S/m.

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