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Corrosion behavior of construction materials for intermediate temperature steam electrolysers

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Electrolysis of water is an important process in the long term visions about the use of hydrogen as an energy carrier[1].

Electrolytes, operating at temperatures above 100 °C under low humidification are expected to overcome several problems, met in low temperature systems[2]. Among those challenges are water management and necessity to use noble electrocatalysts to catalyze the electrode reactions at lower temperatures. Therefore, considerable efforts have been made recently to develop such materials.

The electrochemical behavior of different construction materials was studied in molten $KHSO_4$ and $KHSO_4$-CsH_2PO_4 electrolytes in air atmosphere. Different grades of stainless steel, nickel-based alloys, as well, as platinum, gold and tantalum electrodes were tested at elevated temperatures.

Several types of commercially available stainless steels and nickel-based alloys were evaluated as possible construction materials. Their corrosion resistance was measured under simulated conditions corresponding to those in intermediate temperature steam electrolysers, using proton conducting solid electrolytes.

Steady-state voltammetry was used to detect the corrosion rates and the corrosion potentials of the selected materials[3].

It was shown that stainless steels were the least resistant to corrosion under the anodic polarization. Platinum and CVD-coated stainless steel showed superior resistance to corrosion in the selected media.

The electrochemical evaluation of selected materials was performed in the cell, presented in Fig.1.

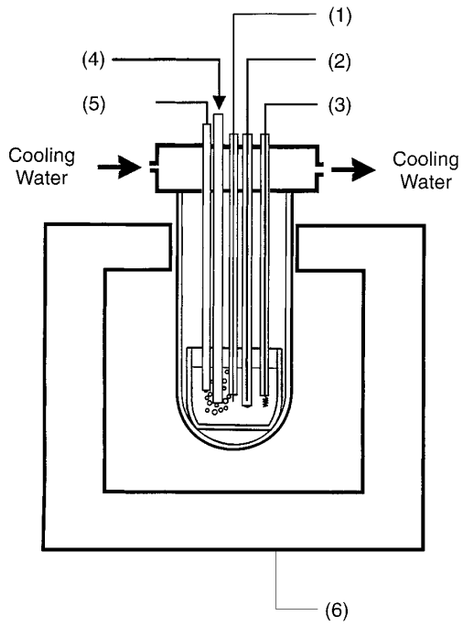

Fig. 1. Electrochemical cell: (1) working electrode; (2) reference electrode; (3) counter electrode; (4) gas inlet; (5) thermocouple, (6) furnace.

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