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Corrosion behavior of construction materials for
intermediate temperature steam electrolyzers

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Electrolysis of water is an important process in the long
term visions about the use of hydrogen as an energy
carrier¹.

Electrolytes, operating at temperatures above
100 °C under low humidification are expected to
overcome several problems, met in low temperature
systems². 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
 $\text{KHSO}_4\text{-CsH}_2\text{PO}_4$ 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 electrolyzers,
using proton conducting solid electrolytes.

Steady-state voltammetry was used to detect the
corrosion rates and the corrosion potentials of the selected
materials³.

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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