

As lead and aluminium (or copper) are practically mutually insoluble at temperatures up to 1000 K, the covering thus obtained consists of pure continuous lead. The lead film varies much in thickness at a number of points over the specimen, but pores never reach through to the aluminium base. The minimum thickness of covering is no less than 80 μm .

Because of the special features of this method of lead plating, the lead covering has a highly developed surface. Thus, the actual surface area of a lead film electrode can be 10 times as great as the apparent one. Lead coating of similar quality was also produced on coarse grids made from technical grade aluminium (99% Al) and aluminium alloys, which have much more prospects as constructive materials because of their better mechanical strength as compared to pure aluminium.

The electrochemical measurements of entirely immersed lead/aluminium electrodes were performed in a standard electrochemical cell under argon atmosphere. A silver chloride electrode (Ag/AgCl/saturated KCl solution) served as reference. 'Extra pure' grade 29 and 32 wt.% H_2SO_4 was used as electrolyte. Cycling of lead film electrode over the range 0.7–2.0 V was carried out under potentiodynamic conditions with a linear scanning rate of 10 mV s^{-1} and holding time of 200 s at the potential limits. The discharge current peak occurs at the potential of 1.5 V for the electrode on the aluminium plate. For an electrode on the aluminium substrate, the minimum value of the peak current density was observed during the first two cycles because of formation of a lead dioxide layer.

The peak discharge current increases up to the sixth cycle and then remains constant during the next 700 cycles. In some instances, the scanning voltammetry was stopped after 300 cycles and the working electrode was left to stand in sulphuric acid solution for 24–72 h. Only during the first cycle after this rest time was the magnitude of current discharge peak low. It then increased and attained its former value. Similar electrochemical behaviour was observed for the lead film electrode on the copper substrate.

It was shown that by exchanging the aluminium plate by a fine grid increases the value of current discharge peak by three–five times. In the case of lead plating onto a thin aluminium grid, we obtained a current density of 350–500 mA cm^{-2} . This value is even higher than that obtained from an electrode on a fine copper grid. During prolonged testing, bulking and scaling of the lead coating was never observed.

*Corresponding author. Tel.: +7-3432-488-153
E-mail address: domnin@ihte.uran.ru (L.A. Yolshina)

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Effect of sulfur and oxygen on the corrosion of stainless steel when in a fuel cell carbonate electrolyte

E.V. Nikitina*, V.Ya. Kudyakov, O.I. Klyushnikov

Institute of High-Temperature Electrochemistry, Urals Branch of the Russian Academy of Sciences, Ekaterinburg, Russia

We have investigated the effect of the corrosion on the steel, 12Cr18Ni10Ti by artificially injecting sulfur-, halogen- and oxygen-containing compounds of sodium into the high-temperature carbonate electrolyte of a fuel cell.

Corrosion resistance of the steel in a carbonate electrolyte has a significant role in the successful realisation of high-temperature devices.

At 873–1073 K, under an atmosphere of carbon dioxide and oxygen (2/1) or under atmospheric air, the interaction of the alkali carbonate melt (carbonates of lithium, sodium, potassium) with steel samples took place in a three-electrode cell with a special port for adding of salts, both when the cell was on open circuit and when it was under anodic potentiostatic polarization. The counter electrode was platinum wire, the reference one was the oxygen-carbonate electrode.

Addition of 2 mol% of sodium peroxide causes a significant shift of the corrosion potential into the electropositive region, with some growth of corrosion rate due to expansion of the thickness of the protective layers. There is a parabolic dependence of the corrosion rate during the steel sample's exposure in the melt.

At high temperature, the introduction of the peroxide into the salt phase resulted in the emergence of different oxygen ions and a layer with a higher oxygen content.

Under anodic polarization, the current density is lower than without excess oxygen, but the magnitude of the passive region does not change. Addition of 2 mol% of sodium halides causes a shift in the corrosion potential of about 0.1 V. Corrosion rate grows with increase of temperature.

Injection of sodium sulfide and sulfate has considerable effect on corrosion processes, both during polarization and on open circuit.

*Corresponding author
E-mail address: domnin@ihte.uran.ru (E.V. Nikitina)