

Corrosion Study of Stainless Steels and Nickel-based Alloys as Construction Materials for Ionic Liquid Hydrogen Compressor

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The corrosion behavior of various commercially available stainless steels and nickel-based alloys as possible construction materials for components which are in direct contact with the five different ionic liquids, selected as performance fluids in an ionic liquid hydrogen compressor was evaluated. An electrochemical cell was specially designed, and the steady-state cyclic voltammetry was used to measure the corrosion resistance of the tested alloys in the selected ionic liquids at the two temperatures of 23°C and 80°C ,and air atmosphere.

The results showed a very high corrosion resistance and high stability of all the tested alloys in the ionic liquids. Comparison of the corrosion current densities at 23 and 80 °C showed the corrosion rate slightly increased at elevated temperature. It was observed that small addition of tantalum, and niobium to the alloys increased the corrosion stability in the studied ionic liquids. Comparison of the corrosion resistance of the nickel-based alloys with stainless steel alloys in all the tested ionic liquids showed that high nickel concentration does not play a significant role on corrosion rate of the tested alloys in the selected ionic liquid electrolytes. Hastelloy[®] C-276 showed the poorest corrosion resistance in all the tested ionic liquids. AISI 316L with high corrosion resistance and the lowest price is recommended as the most attractive construction material for all the components which are in direct contact with the studied ionic liquids in an ionic liquid hydrogen compressor.