The Influence of Solvent Nature on Corrosion Behaviour of Zr in Hydrochloric Acid Solutions

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The influence of the solvent nature (water, ethanol, ethylene glycol) on the corrosion behaviour of Zr in the hydrochloric acid solutions has been studied.

In the aqueous HCl solutions (1-5 mole/l) Zr is corrosion resistant because of formation of the protective oxide film on its surface. In nonaqueous ethylene glycol and ethanol hydrochloric acid solutions Zr is activated during some interval of time (duration of which increases with decreasing HCl concentration and temperature) and its dissolution begins to proceed with hydrogen evolution.

Under the same conditions the corrosion rate of Zr decreases in the line

ethanol – ethylene glycol – water

from the left to the right. Corrosion potentials of Zr increase during time in aqueous HCl solutions and decrease in the ethanol and ethylene glycol solutions of HCl.

In the ethanol and ethylene glycol HCl solutions (3 M) a dissolution rate of Zr calculated by weight loss doesn't depend of potential in some interval of anodic potentials and exceeds the corresponding anodic current density ten times. This fact allows to assume a chemical mechanism of metal dissolution at the same time with an electrochemical one.

The influence of water additions into the alcohol 3 M HCl solutions on the corrosion and corrosion potential of Zr has been investigated. In the ethanol hydrochloric acid solutions water additions (1-7%) increase corrosion rate and decrease corrosion potential of Zr. In the ethylene glycol solutions the same influence of water additions is observed when C (H2O) less 1% only. Zr becomes passive when water concentration exceeds 10% in the ethanol HCL solutions and 2% - in the ethylene glycol ones. The influence of water concentration in the alcohol HCl solutions on the corrosion behaviour of Zr has been studied up to 99%.

The influence of ions-reductants and ions-oxidants as inhibitors of Zr corrosion in above media has been studied. The electrode surface has been investigated in situ by the photo electrical polarization method.