Olga Yeliseyeva

Interaction of iron and stainless steels with oxygen containing Pb/ Pb-Bi melts (aspects of simulation)

Abstract

The corrosion aggressiveness of liquid metals with regard to the structural materials and protective oxide coatings is one of the main issues of advanced reactor materials science.

In the proposed presentation the interaction of components in the Fe[Cr] / Pb,Bi[O] systems from the stand point of protective oxide layer formation on the interface “solid metal / liquid metal” is considered

The corrosion behavior of different materials (Fe-Armco, ferritic- and ferritic-martensitic steels) in the heavy melts (Pb- and Pb-Bi) is presented.

The features of double oxide layer structure depending on the various experimental conditions (temperature and exposure time; oxygen concentration in liquid metal, material composition and others) are revealed and discussed.

Based on the obtained experimental results and analysis of literature data the phenomenological model of growth of the duplex scale on the interface “solid metal-liquid metal” is proposed. The model demonstrates the main stages of double oxide layer evolution: origin, stable growth, accumulation of defects and degradation in the liquid metal environment.

The simulation of the oxidation of Armco-Fe (as a model material) in liquid lead under saturated condition (10^{-3} wt %O) at 550°C was carried out. The math model takes into account the change of iron diffusivity in the magnetite because of increasing defectiveness of scale with time. The calculations provided accordingly proposed model reflect more precisely the real kinetics of oxidation of Armco-Fe in the liquid lead saturated by oxygen at 550°C