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Investigation of steel corrosion products mass transfer in sodium

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The report observes the behavior of the system sodium - oxygen - stainless steel with regard to the sodium cooled circulation loop. Computational and theoretical analysis of mass transport of corrosion products in the channels of non-isothermal circuit in view of chemical interaction of the components of steel with oxygen in sodium, including the reaction of sodium oxide with chromium in sodium is prepared.

In the proposed model, we consider the reaction of sodium oxide with chromium in sodium in chromium-nickel steel circuit, taking into account the transfer of the reaction products in sodium and dynamics of sodium flow. The processes of impurities interaction with channel walls, formation and transport of suspended particles in the flow of coolant are considered. Closing relations include the equations describing the mass transfer of impurities between the coolant flow and the channel walls, the deposition of particles on the channel surface, the heat exchange between the coolant flow and channel walls.

On the basis of the calculation and the theoretical analysis is refined information about physical and chemical constants, characterizing the mass transport of corrosion products in sodium at presence of increased content of impurities such as oxygen and hydrogen.

Experimental study of mass transfer components of steel in sodium at low and high oxygen content in sodium is carried out. At low oxygen content the composition of the deposition is similar to that of steel dissolved. For the case of high oxygen concentration are performed two experiments: the oxygen content in sodium of 80 ppm and 140 ppm. The comparison of the calculation results with the experimental data on distribution of the chromium deposits in the cooling channels is completed, on which basis are defined updated values of the constants that characterize the mass transfer of chromium by dissolving stainless steel in sodium.

It was found that an increase in the level of dissolved oxygen in sodium increases the solubility of chromium also.

Country/Int. Organization

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