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Methods of controlling concentration of oxygen dissolved in heavy liquid metal coolants (lead and lead-bismuth) of nuclear reactors and test facilities

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Heavy liquid metal coolants (HLMC) including lead-bismuth and lead make significant corrosion and erosion impact on structural steels. The only way to assure the long-term reliable operation of steels of the primary system components operating in contact with HLMC is to provide protective coating on the steel surface. By now, oxygen-based technology of structural steel surface passivation has been chosen for this purpose. This technology implies formation of protective oxide films on the steel surface and assurance of their integrity during plant operation by maintaining specified oxygen potential of coolant.

In case of HLMC circuits operation without purposeful supply of dissolved oxygen to the coolant spontaneous deoxidization of coolant takes place down to the level, at which corrosion protection of structural steels cannot be provided. Therefore, stable and reliable protection of steels contacting with HLMC requires adding of dissolved oxygen to the coolant on a regular basis during specified plant lifetime.

SSC RF –IPPE specialists proposed various methods of continued maintaining of desired HLMC oxygen potential in both nuclear power plants and experimental facilities. These methods have been developed using test facilities. Currently, the efforts are focused on the development of systems and equipment for implementation of technology of maintaining specified oxygen potential of HLMC in the advanced reactor designs (BREST-OD-300, SVBR-100, etc.).

Solid-phase method of oxygen content control for maintaining specified oxygen potential in HLMC is the most promising. This method developed by the SSC RF –IPPE is based on the use of mass exchangers with solid-phase source of oxygen.

For the moment, over 50 various mass exchanger designs have been developed by the SSC RF –IPPE specialists. They differ from each other in the arrangement of solid-phase lead oxides dissolving process. Large experience of their operation in test facilities with HLMC has been gained.

In the paper presented are the various methods of maintaining specified HLMC oxygen potential and approaches to their implementation based on the experience gained in operating various experimental facilities and power plants located in the research institutes of the Russian Federation.

Country/Int. Organization

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