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The Experimental Study to Support IVR Strategy

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For alleviating the severe accident damage in nuclear power plant, In-vessel retention (IVR) is used on the severe accident management strategy in light water reactor. The criterion of IVR effectiveness is the safety margin, the value that between the melt pool heat flux and the critical heat flux on the lower head, matching the design requirements. For enhance the safety margin, the melt pool heat flux and the critical heat flux should be investigated.
In the molten pool, the heat transfer behavior of metal layer is the focus problem because of the thermal focus effect. Therefore, the HELM was built to study the heat transfer correlations under the IVR conditions. The Globe-Dropkin correlation and Chu-Churchill correlation has been widely used to calculate the heat flux in the metal layer. However, the Rayleigh number (Ra) for the developed Power Plant has been shown to exceed the valid range for the G-D correlation. At the same time, other studies have shown that most correlations are far from the G-D correlation. Therefore, HELM verified the G-D correlations under the high Ra condition. The relationship between axial and radial heat transfer in the metal layer will also been studied.
The behaviors of CHF varying with angular positions and the concentrations of coolant chemistry are investigated by the FIRM facility. FIRM is built to embody some key factors that influence the CHF: the heater block is 30o arc of circle with full-scale radius, and is made of the copper block covered by a thin carbon steel layer. The test section can be positioned in three tilted angles. Also, the effect of coolant chemistry will be examined by the mixed solution of water, deionized water, boric acid and tri-sodium phosphate.

Country or International Organization

China

Primary author: MA, Li (State Nuclear Power Technology R&D Centre, China)

Co-authors: Mr HU, Teng (State Nuclear Power Technology R&D Centre); Mr LU, Wei (State Nuclear Power Technology R&D Centre)

Presenter: MA, Li (State Nuclear Power Technology R&D Centre, China)

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