An Analysis of Critical Heat Flux on the External Surface of the Reactor Vessel Lower Head

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Abstract

CHF (Critical heat flux) on the external surface of the reactor vessel lower head is major key in the evaluation on the feasibility of IVR-EVC (In-Vessel Retention through External Vessel Cooling) concept. To identify the CHF on the external surface, considerable works have been performed. Through the review on the previous works related to the CHF on the external surface, liquid subcooling, induced flow along the external surface, ICI (In-Core Instrument) nozzle and minimum gap are identified as major parameters. According to the present analysis, the effects of the ICI nozzle and minimum gap on CHF are pronounced at the upstream of test vessel: on the other hand, the induced flow considerably affects the CHF at downstream of test vessel. In addition, the subcooling effect is shown at all of test vessel, and decreases with the increase in the elevation of test vessel. In the real application of the IVR-EVC concept, vertical position is known as a limiting position, at which thermal margin is the minimum. So, it is very important to precisely predict the CHF at vertical position in a viewpoint of gaining more thermal margins. However, the effects of the liquid subcooling and induced flow do not seem to be adequately included in the CHF correlations suggested by previous works, especially at the downstream positions.