5 - 24 Simulation Analysis of Condensation HeaT Transfer Inside C-type TubeS Based on RELAP5/MOD3.2

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1-Electric heatin Boiler 2-Condenser 3-Experimental water tank 4-C-type tubes 5-Condensate measuring tank 6-Distilled water tank 7-Submersible pump 8-Storage tank.

Fig. 1 A schematic diagram of the PRHR HX condensation experimental facility. The RELAP5/MOD3.2 code was validated with experimental data for simulating the condensation heat transfer characteristics inside C-type tubes of the passive residual heat removal heat exchanger (PRHR HX). The schematic diagram of the experimental system, which consists of the condensation heat transfer circuit, the boiling heat transfer circuit, the cooling water circuit and related measurement facilities, is shown in Fig. 1.

In order to eliminating the effects of the boiling heat transfer model out of the tubes when simulating the condensation, the C-type tube condensation simulation, in which the wall temperature was given, was performed using RELAP5/MOD3.2 code. The nodalization scheme of RELAP5/MOD3.2 for PRHR HX condensation experiments is shown in Fig. 2.

As shown in Fig. 3, Comparing the simulation results with the experimental data, it is found that the maxi-



Fig. 2 Nodalization scheme of RELAP5/MOD3.2 for the condensation experimental facility.



Fig. 3 Comparison of the average condensation heat transfer coefficient of tube A calculated using different condensation models.

mum relative deviation between the experimental and calculated condensation heat transfer coefficients exceeds 80% in the range of experimental date, and the change tendency of the average condensation heat transfer coefficients is obviously different with the increase of the outlet condensate Reynolds. RELAP5/MOD3.2 code uses Chato model to calculate the condensation of the horizontal part and uses the Nusselt model to calculate the condensation of the vertical part when simulating the C-type condensation experiment in the range of experimental parameters. The results show that the standard RELAP5/MOD3.2 code cannot give completely reliable predictions when simulating the C-type tubes.