

A Study of the Reflood Characteristics Under Small and Medium LOCA Using A 3x3 Heater Bundle

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1. Introduction

For a loss-of-coolant accident (LOCA) conditions in a pressurized-water reactor (PWR), the coolant level decreases and then fuel core is uncovered. The cladding temperature of uncovered fuel increases until the reflood phase, which is a process to refill coolant into the core. This phase is called Reflood. Generally, core experiences highest temperature during the reflood phase. Therefore, understanding the reflood phenomena is required to prevent a severe accident. KAERI have studied the reflood characteristics [1] ~ [3]. Research for the reflood under low pressure condition for the LBLOCA simulation had been done with AHER facility at KAERI. In the present experimental program is the reflood test under medium and high pressure condition for SBLOCA or MBLOCA. In the present paper, experimental results with 3x3 rod bundle under 10~80 bar is analyzed. Additionally, calculation results using MARS-KS are compared with experimental results.

2. Experimental facilities and conditions

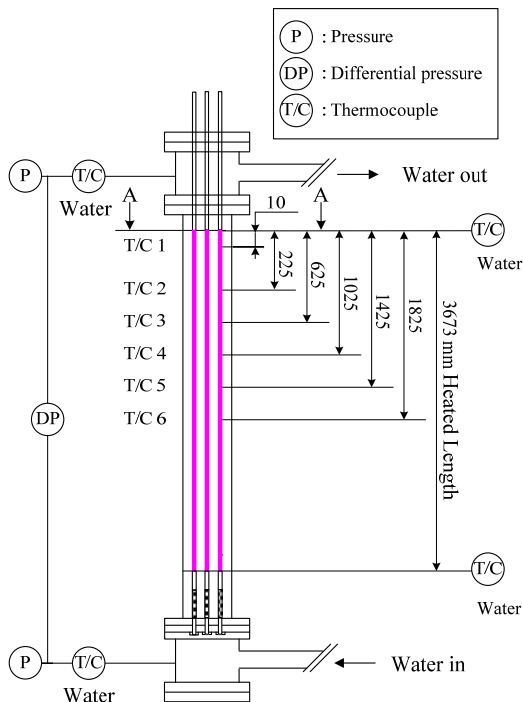
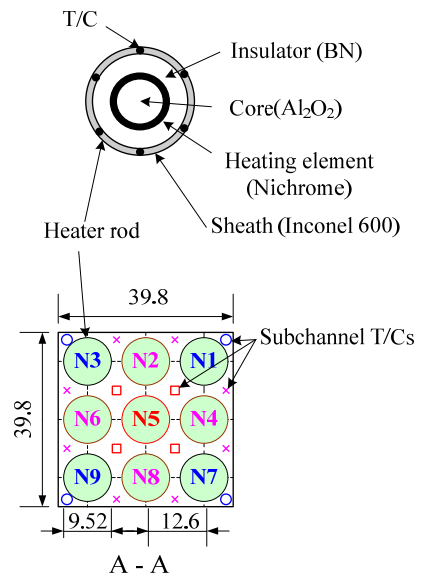


Fig. 1. Schematic diagram of test section



- Central subchannel
 - × Peripheral subchannels
 - Corner subchannels
- Central rod: N5
 Peripheral rods: N2, N4, N6, N8
 Corner rods: N1, N3, N7, N9

Fig. 2. Geometry of 3x3 rod bundle

The reflood experimental facility for medium and high pressure has 9 electric heater rods. A diameter is 9.52mm, a pitch of rods is 12.6mm, and the heating length is 3673mm. Each heater has 6 thermocouple on the upper side of it because upper side temperature is higher than lower side. The test pressure is 10 ~80 bar, initial collapsed water level is 0 ~ 1.5 m, total power is 10~40 kW, subcooling of coolant is 40~110 °C, reflood rate is 1~7 cm/s, and initial maximum heater temperature is 500~660 °C.

3. Experimental results

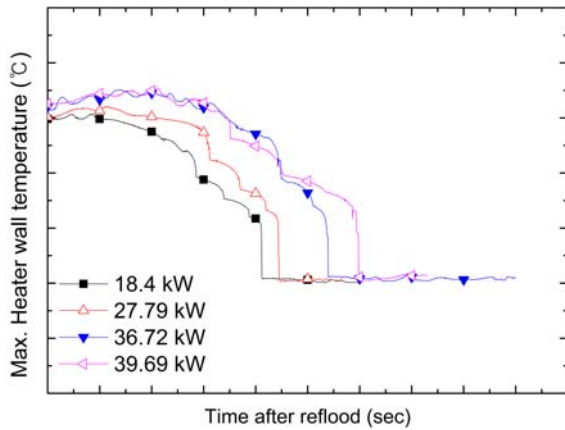


Fig. 3. Power effect on the maximum wall temperature behavior

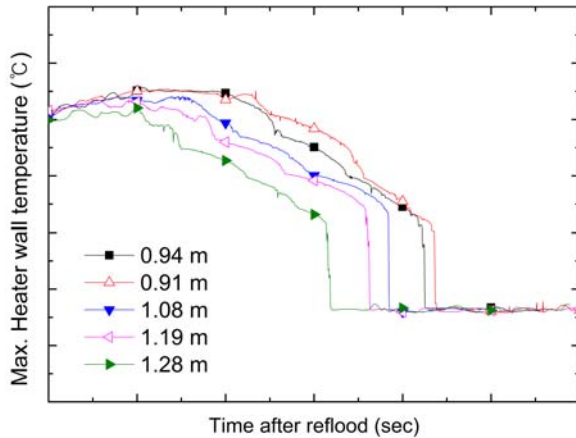


Fig. 4. Initial level effect on the maximum wall temperature behavior

PCTs for every case is compared. High power, high initial temperature, low reflood rate show high PCT. Some cases were calculated using MARS-KS. And they compared with experimental results.

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