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Jet Impingement Width Calculation for Flat Plate

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Abstract

The flow behavior of the direct vessel injection (DVI) system is important in the analysis of a loss of coolant accident (LOCA) in the Korean Next Generation Reactor (KNGR). Particularly, the flow regime in the downcomer demonstrates thermal-hydraulic characteristics which still defy full understanding. One of the unknown characteristics is the flow velocity profile. The flow behavior during injection is related to the steam path and the amount of bypass of the emergency core cooling (ECC) water. One can obtain the information in an analytical, numerical, or empirical way. First, the analytical method turns out to be only limited in solving the problem at hand because the available equations are not enough to account for all the unknown parameters relevant to the phenomena. In addition, the mathematical and physical methods do not necessarily yield the correct flow pattern. To overcome the limit of this analytical method, a simple experiment was conducted. Two flat acryl plates were used, and the conductance method was used to measure the flow width and thickness. The principle of measurement is that the resistance changes when the sensor reaches the fluid film. Results of the measurements are easily understandable. The outer boundary of and the center of the fluid flow are thick. Also, faster the injection velocity, the larger the flow width. It is remarkable that the velocities at the same spot are nearly identical regardless of the injection velocity. It is considered that, independently of the injected velocities, the spreading effect and the viscosity effect equalize the vertical velocity downstream.