An Analytical Evaluation for the Pressure Drop Characteristics of Bottom Nozzle Flow Holes

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Abstract

An analytical evaluation for the bottom nozzle flow holes was performed to find a best design concept in terms of pressure drop. For this analysis, computational fluid dynamics (CFD), FLUENT 5.5, code was selected as an analytical evaluation tool. The applicability of CFD code was verified by benchmarking study with Vibration Investigation of Small-scale Test Assemblies (VISTA) test data in several flow conditions and typical flow hole shape. From this verification, the analytical data were benchmarked roughly within 17% to the VISTA test data. And, overall trend under various flow conditions looked very similar between both cases. Based on the evaluated results using CFD code, it is concluded that the deburring and multiple chamfer hole features at leading edge are the excellent design concept to decrease pressure drop across bottom nozzle plate. The deburring and multiple chamfer hole features at leading edge on the bottom nozzle plate have 12% and 17% pressure drop benefit against a single chamfer hole feature on the bottom nozzle plate, respectively. These design features are meaningful and applicable as a low pressure drop design concept of bottom nozzle for Pressurized Water Reactor (PWR) fuel assembly.