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# Numerical Investigation of $AL_2O_3$ Nanoparticle Effect on a Boiling Forced Swirl Flow Field

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**Abstract :** One of the most important issues in the design of nuclear fusion power plants is the heat removal from the hottest region at the diverter. Various methods could be employed in order to improve the heat transfer efficiency, such as generating turbulent flow and injection of nanoparticles in the host fluid. In the current study, Water/$AL_2O_3$ nanofluid forced swirl flow boiling has been investigated by using a homogeneous thermophysical model within the Eulerian-Eulerian framework through a twisted tape tube, and the boiling phenomenon was modeled using the Rensselaer Polytechnic Institute (RPI) approach. In addition to comparing the results with the experimental data and their reasonable agreement, it was evidenced that higher flow mixing results in more uniform bulk temperature and lower wall temperature along the twisted tape tube. The presence of $AL_2O_3$ nanoparticles in the boiling flow field showed that increasing the nanoparticle concentration leads to a reduced vapor volume fraction and wall temperature. The Computational fluid dynamics (CFD) results show that the average heat transfer coefficient in the tube increases both by increasing the nanoparticle concentration and the insertion of twisted tape, which significantly affects the thermal field of the boiling flow.

**Keywords :** nanoparticle, boiling, CFD, two phase flow, alumina, ITER
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