Abstract Submitted
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Spray impact on a smooth, unheated surface: drop impact cavity diameter vs time[1] JOHN KUHLMAN, JONATHAN TAYLOR, NICHOLAS HILLEN, CHRISTOPHER SOMMERS, West Virginia University, Mechanical and Aerospace Engineering Dept., WVU SPRAY COOLING LABORATORY TEAM — A dense water spray impacting a smooth, unheated glass surface is studied. Average drop diameter is 90-60 microns; average axial velocity is 7.5-12 m/s for nozzle pressures of 1.4-4.2 bar gage, respectively, from PDPA data. Average spray Weber numbers are 70-130. Half the spray mass flux is due to larger drops with Weber numbers of 200-800, causing the splashed secondary drops and large impact cavities with longer lifetimes. Liquid film thickness is about 160 microns at all radii over the present range of nozzle pressures, with transient fluctuations of 30-40 microns. This thickness increases vs drop radial impact location, and decreases vs nozzle pressure. Drop impact cavity diameter from video images is 0.5 mm-1.5 mm, giving drop diameters of 100-300 microns, consistent with the PDPA data. Spray drop impact cavity growth vs time is fit approximately by $(t)^{0.2}$ as seen in the literature. These results will be used to improve correlations in an existing preliminary Monte Carlo model of the complex spray impact process. It is believed that the transient thin liquid films formed beneath the droplet impact cavities are an important source of heat transfer augmentation via transient conduction.

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