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Ultra-high speed visualization of the flashing instability under vacuum conditions JOSE FEDERICO HERNNDEZ SNCHEZ, TARIQ ALGHAMDI, SIGURDUR T. THORODDSEN, King Abdullah University of Science and Technology — We investigated experimentally the flashing instability of a jet of perfluoro-n-hexane (PFnH) released into a low-pressure environment. Using a ultra-high speed camera we observed the jet fragmentation occurring close to the nozzle. Using a fixed total driving pressure, we decreased systematically the vacuum pressure, investigating the transition from a laminar jet to a fully flashing jet. Our high temporal resolution allowed to visualize the detailed dynamics of external flash-boiling for the first time. We identified different mechanisms of jet break-up. At chamber pressures lower than the vapor pressure the laminar jet evolves to a meandering stream. In this stage, bubbles start to nucleate and violently expand upstream the nozzle. At lower vacuum pressures the initially cylindrical jet elongates, forming a liquid sheet that breaks in branches and later in drops. At very low pressures both mechanisms are responsible for the jet breaking. We calculated the size distribution of the ejected droplets, their individual trajectories, velocities as well as the spray angle as a function of the dimensionless vacuum pressure.

Jose Federico Hernndez Snchez
King Abdullah University of Science and Technology

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