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Broadband X-ray Imaging in the Near-Field Region of an Airblast Atomizer[1] DANYU LI, JULIE BOTHELL, TIMOTHY MORGAN, THEODORE HEINDEL, Iowa State Univ — The atomization process has a close connection to the efficiency of many spray applications. Examples include improved fuel atomization increasing the combustion efficiency of aircraft engines, or controlled droplet size and spray angle enhancing the quality and speed of the painting process. Therefore, it is vital to understand the physics of the atomization process, but the near-field region is typically optically dense and difficult to probe with laser-based or intrusive measurement techniques. In this project, broadband X-ray radiography and X-ray computed tomography (CT) imaging were performed in the near-field region of a canonical coaxial airblast atomizer. The X-ray absorption rate was enhanced by adding 20% by weight of Potassium Iodide to the liquid phase to increase image contrast. The radiographs provided an estimate of the liquid effective mean path length and spray angle at the nozzle exit for different flow conditions. The reconstructed CT images provided a 3D map of the time-average liquid spray distribution. X-ray imaging was used to quantify the changes in the near-field spray characteristics for various coaxial airblast atomizer flow conditions.

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