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Experimental Analysis on the Temperature Influence on Secondary Atomization

Master's Thesis

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Motivation

Powder based additive manufacturing of metal parts requires metal powder. For high quality parts the requirements on the shape and the size of the metal powder are very high. The main way of producing metal powder is by atomization of a liquid metal jet in a gas atomizer. The key process which determines the powder quality is the secondary atomization, where single droplets break into multiple child droplets. Secondary atomization has been studied extensively in the past, however only few experiments investigate the influence of the temperature on the atomization process. To investigate this, we use a shock tube to atomize single water droplets at different temperatures and record their breakup using a high-speed camera.

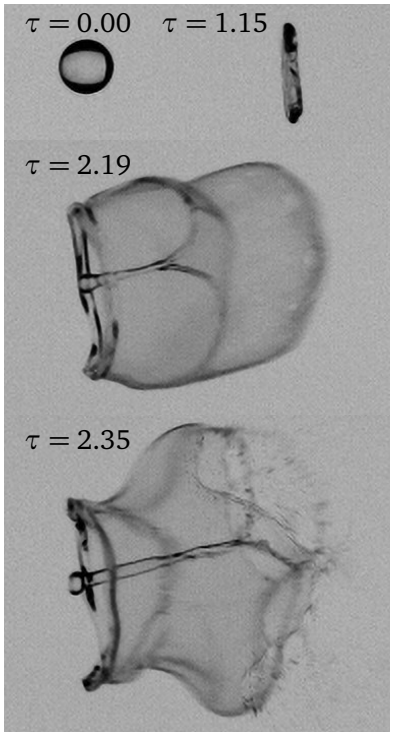

Figure 1: Water droplet atomizing at $We \approx 20$

Objectives

In this thesis, the influence of the temperature on secondary atomization shall be investigated. First, an assembly to heat water to a set temperature and generate droplets shall be designed. After testing the droplet generator, water droplets with different temperatures are atomized in a shock tube and their breakup is recorded using a high-speed camera. Experimental data are processed using MATLAB and experiments at different temperatures are compared. Finally, using the experimental results, the influence of the temperature on secondary atomization shall be investigated.

Requirements

- Experience in experimental working
- Knowledge of gasdynamics
- Experience in CAD design
- Knowledge of MATLAB not necessary but advantageous

What you learn during this thesis

- Working with a shock tube
- Understanding of multiphase flow phenomena