Image particle sizing of an air blasted liquid sheet of kerosene at intermediate pressure

C. Hennig[1*], F. Giuliani[1], S. Freitag[2], C. Hassa[2]
[1]Institute for Thermal Turbomachinery and Machine Dynamics,
Graz University of Technology, Graz, Austria
[2]Institute of Propulsion Technology,
DLR e.V. - German Aerospace Center, Cologne, Germany

Abstract

This paper presents a method of image processing to analyze the atomization of a prefilming airblast atomizer. The results of this analysis are based on atomization images obtained by previous experiments performed with kerosene on a flat liquid sheet airblast atomizer at intermediate pressure and room temperature (Bhayaraju [1]). The main objective of this study is to investigate the successive atomization process and to evaluate a correlation for droplet size distributions which can be used to specify the spray in numerical simulations [2] and to understand the atomization regimes for an appropriate introduction of the liquid phase. In the prefilming atomizer the closed tube-shaped original film is modeled as a flat film for both optical access and ease of manipulation. The 2-D laboratory atomizer had a prefilmer length of 4 mm and an injection slit of 0,3 mm. The evaluated images show the prefilmer surface and the primary breakup zone and are analyzed by classifying the size and position of ligaments and droplets. Due to various changes in liquid mass flow, air pressure and air velocity it is possible to obtain size distributions for a wide range of parameters. All analysis was done using a self-developed image processing code based on Matlab. In this paper, we focus on the width and length of the attached ligaments. Based on these shape parameters probability density functions are estimated for the intermediate status of atomization at the prefilmer lip.
This study is based on a collaboration of DLR Cologne and TU Graz and is supported by the Austrian Science Fund (FWF).

Key words: Image Processing, Prefilming Airblast Atomization, Liquid Sheet Breakup

*Corresponding author, christoph.hennig@tugraz.at