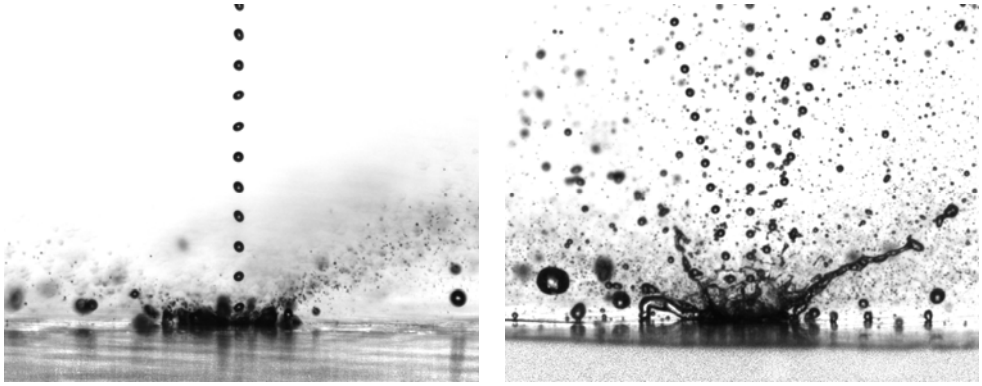
From Single Droplet to Spray Wall Interaction – Multiple Droplet Chains

A. Müller*, E. Velios, K. Dullenkopf and H.-J. Bauer
Institut für Thermische Strömungsmaschinen
Universität Karlsruhe (TH)
Karlsruhe, Germany

Abstract

The further development of internal combustion engines is aimed towards higher efficiency and lower emissions. To achieve this goal, a detailed understanding of the mixture formation process is a crucial prerequisite. To enhance mixing and combustion quality, a general trend to higher fuel injection pressures, which leads to generation of droplets in a range below 20 µm, is evident. In the effort to study more realistic conditions and to achieve a more realistic database, the steps from single droplet over droplet chain experiments and now to multiple chain experiments have been made at the ITS. In this paper, the experimental setup and the results of a study under conditions as realistic as possible for DISI engines, with elevated pressure up to 3 bar, a heated wall element and droplets in the 80 µm scale are described. The wall element and the droplet chain generators are contained in a pressure vessel with adequate optical access. To simplify the complex spray and to allow extensive detailed measurements, up to three droplet chain generators are used, producing monodisperse equidistant droplets under elevated pressure. The droplets in this setup are slower and bigger compared to a DISI engine, but the resulting Reynolds number is in the range from 1500 to 2500 and therefore in the relevant range. This setup establishes well-defined boundary conditions and allows examination of the impingement process in detail. Various parameter studies are performed. The secondary droplets are analyzed by means of an enhanced particle Tracking Velocimetry (PTV) method. As a result, secondary droplet diameters are predicted successfully using an approach based on the Reynolds number.



Key words:

DISI spray, Droplet-wall-interaction, Particle Tracking Velocimetry, Droplet Chain

*Corresponding author, armin.mueller@its.uni-karlsruhe.de