Fuel injection measurements with CAVILUX® Smart diode laser

RWTH AACHEN UNIVERSITY

WSA Lehrstuhl für Wärme- und Stoffübertragung Aachen
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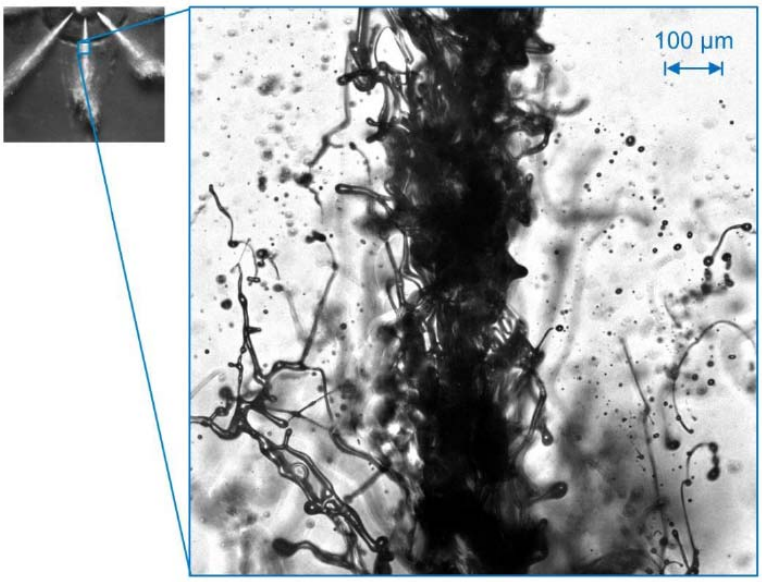
The form of a fluid jet is highly determined by the collapse of the jet near the nozzle. This phenomenon is also known as primary collapse. Based on this knowledge various experimental, numerical and theoretical studies about the primary collapse have been performed worldwide in the past. However, especially under the conditions in diesel engines the mechanisms of the collapse have not been sufficiently understood. This lack of understanding originates in the lack of established data about form, size and velocity of the fragments in liquid jets. Motivated by the belief that the spatial resolutions that have been reached in current literature are too small to visualize the smallest of fluid structures but there are possibilities to improve the situation. The Institute of Heat and Mass Transfer (WSA) of the RWTH Aachen University has recently developed a new double-pulse backlight microscope [1]. The images that have been acquired with this measurement method contain information about primary fluid structures with a special resolution that has not been reached so far.



The double-pulse back illumination microscopy creates photographic images of the area of interest of the primary collapse with high special resolution and at the same time low motion blur at two different times during the injection. Amongst other settings this is enabled with the use of a pulsed light source (CAVILUX Smart by the company Cavitar Ltd.). The light source emits the two short light pulses (pulse duration: 10 ns) within short time (1 µs). In addition the light is monochromatic and incoherent which is a major advantage in microscopic imaging.
The microscopic optic in its current development state is able to visualize the area of the primary collapse of diesel jets with 600 nm/pixel and a special resolution of 2 µm. Based on the acquired double images not only the size, form and amount of primary fluid structures can be identified with appropriate analysis tools but also the velocity can be measured.

[1] Reddemann, M. A., Mathieu, F., Kneer, R. (2013) Transmitted light microscopy for visualizing the turbulent primary breakup of a microscale liquid jet, Experiments Fluids, 54(11).

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