Karlsruhe Institute of Technology

Research

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Droplet/Wall-Interaction in Urea-SCR systems

Background:

The selective catalytic reduction (SCR) is an important technique to reduce NO_x-emissions in the exhaust gas of diesel-powered engines. Ammonia is used as reducing agent, which is carried in the vehicle in form of an 32 wt- % urea water solution. The urea water solution is injected into the exhaust pipe in front of the catalyst, where the evaporation of the solution and the decomposition of urea releases the required ammonia. Due to highly transient operating conditions, the high amount of required urea water solution and the short distance between injection and catalyst, droplets of the spray may not only impact on the hot exhaust pipe but also on the porous catalyst surface. The resulting liquid film and the subsequent formation of solid deposits may block channels of the monolith and reduce the catalytically active area. For avoidance of deposit formation, the understanding of droplet/wall interaction is a crucial factor.

Project:

Droplet impact experiments are recorded with a high-speed imaging system and characterized via image analysis. The outcome of droplet impact is dependent on wall temperature, droplet momentum and substrate properties. The impingement behaviour is classified in interaction regimes and depicted in regime maps in dependence of thermal and kinetic parameters. Experimental parameter studies of droplet impact on different porous substrates enable the determination of the influence of substrate porosity on the regime thresholds. High-speed recordings of the droplet impact on porous and non-porous substrates are available at http://www.itcp.kit.edu/deutschmann/english/2164.php.

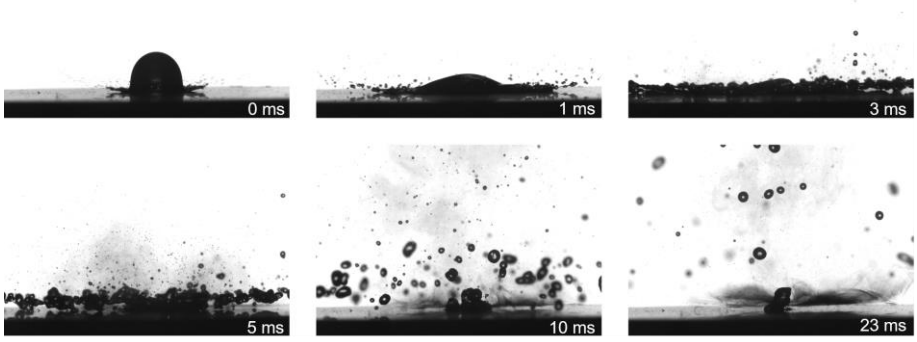

Figure 1: Droplet impact on a porous substrate at high temperatures.

Further experiments focus on the effect of coating, e.g. TiO_2 or catalytic washcoat, on the outcome of droplet impact. The experimental results serve as database for modelling the droplet/wall-interaction on porous surfaces.

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