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# Experimental Investigation of the Influences of Fluid Properties on Heat Transfer for Spray Cooling

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***Abstract*** **-** With electrification of the power train, spray cooling becomes more and more important for automobile applications and its electronic components. That's why this investigation focuses on heat transfer performance of spray cooling under automobile boundary conditions. These conditions include wall temperatures below boiling temperature of the fluid, small nozzle to target distances, low nozzle pressures and a vertically positioned target. In order to enable direct contact of the fluid with the electronic components, electrically insulating fluids need to be used. The properties of these dielectric fluids vary in a wide range. Hence this investigation puts special emphasis on the influence of fluid properties on spray cooling. As working medium, water and two water-glycerol mixtures at different temperatures were used to imitate viscosities of exemplary dielectric fluids. The investigated Prandtl numbers range between 5 and 328. To measure heat transfer, an experimental setup based on a steady-state measurement principle was used. A Nusselt correlation, depending on Prandtl and Reynolds number is proposed. The measurement results of heat transfer showed an almost linear dependency on mass flow rate, when spray droplets were impinging on the target. For lower Reynolds numbers, where no spray forms, but an impinging jet sustains, lower heat transfer is observed and the linear dependency does not hold. The droplet size seems to have a negligible effect on heat transfer.

***Keywords*****:** Spray cooling, dielectric fluid, Nusselt correlation, heat transfer.