Transient cooling of solid surfaces by water droplet evaporation has been investigated through controlled experiments using a large heated aluminium cylinder.

Quantitative prediction of droplet evaporation time and in depth transient temperature distribution in the solid have been made. In the case studied, a single droplet is deposited on a horizontal non-porous surface with initial temperaratures in the range of 75° C to 100°C.

The liquid-vapour interfacial temperature and the water vapor molar fraction in the air at the exposed surface of the water droplet are deduced from the coupled heat and mass transfer energy balance at the interface. Spacial and temporal integration of the overall droplet energy equation is used to predict the instantaneous evaporation rate and the droplet evaporation time.

The boundary conditions for the wetted region proposed by Seki are used to obtain the transient temperature distribution for a semi-infinite solid. The region of the body affected by the droplet cooling is identified and its volume (normalized with the volume of the droplet) is plotted against the evaporation time.

All data, regardless of the droplet volume or of the initial body surface temperature, lie within a narrow band about a straight line.

This finding is the first important step to obtain a simple model for spray cooling based on local accurate description of the droplet-solid interactions. Modelling of spray cooling phenomena is the foundation for the construction of a thermal model for solid fuel fire extinguishment.