The thermal behavior of a hot aluminum surface subjected to cold water droplet impingement is investigated. Evaporation phenomena of a single droplet of pure water is studied for initial surface temperature ranging from 75 to 100oC (implying full suppression of nucleate boiling). The effect of droplet release height, initial surface temperature and droplet volume on the geometrical configuration of the droplet is investigated.

A computer model is developed to predict the cooling effect (volume of influence) induced by a single droplet in contact with the hot surface, using finite difference techniques. A model to predict the evaporation of water droplets deposited on a hot non-porous solid surface is derived.

The water-vapor molar fraction in the air at the exposed surface of the water droplet is deduced from the coupled heat and mass transfer energy balance. Spacial and temporal integration of the overall droplet energy equation is used to predict the droplet evaporation time and the instantaneous evaporation rate. Model predictions agree well with experiments.

The model is used to quantify spatial and temporal heat fluxes distribution at the exposed surface of the water droplet. The volume of influence is found to correlate linearly with the evaporation time. This finding is particular important in light of the modelling of multidroplets cooling effect.