Effect of Charge on Aerodynamic Breakup of Charged Water Droplet

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Abstract. This study concerns experimentally the secondary breakup morphology of water charged droplets with the action of aerodynamic force in the dripping mode. A new measurement of charge-to-mass ratio has been designed and succeeds in calculating the tiny charge (nC) on a droplet. The high-speed camera combined with a microscopic zoom lens has been used to take images of the breakup morphology of charged and uncharged droplet with air assistance, and the differences which is calculated by the image processing technology is used to analyze the effect of charge on droplet deformation and breakup. The results show that two kinds of charged droplet of size 2.8mm are measured to have 32% and 50% of the rayleigh charge limit, respectively. Drop charging enhances drop deformation in the vibrational regime and makes droplet deform more easily because of the lower surface tension caused by electrostatic force. It seems no new breakup modes are observed for charged drop but large differences are observed from breakup morphology and breakup time compared to uncharged drops. And it indicates that charged drop can gain faster breakup equal to uncharged drop of higher *We* as a result of the electrostatic Weber number.

Keywords: Charged droplet; Air assistance; Secondary Breakup; Charge-to-mass ratio; High-speed camera; Breakup time; Breakup morphology.