Abstract Submitted
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Three-dimensional Modelling of Two-phase Flow involving Droplets and Atmospheric Pressure Discharge[1] M.M. IQBAL, Dublin City University, C.P. STALLARD, D.P. DOWLING, University College Dublin, M.M. TURNER, Dublin City University — We employ a three-dimensional coupled fluid-droplet model (FD3d) to describe the complex mechanism of droplet-plasma interaction that occurs when a liquid precursor is injected through a nebulizer into an atmospheric pressure discharge (APD). The formation of conducting channels in the APD plasma illustrates that the electron concentration around the pulse of droplets emitted by the nebulizer is perturbed by the influence of different gas impurities due to the impact of Penning ionization. The development of the sheath potential around the pulse of HMDSO droplets is significantly stronger in the case of He-air than a He-N2 gas mixture, which illustrates the contribution of oxygen impurities. The volumetric density profiles of ionic species are discussed by describing the complex situation of two-phase flow at distinct driving frequencies (5 - 100 kHz). The uniform structure of APD plasma is formed by considering an appropriate size distribution of droplets because the non-uniformities grow due to the existence of larger radii of droplets. The comparison of numerical modelling results of droplet size distributions is performed with experimental measurements using laser diffraction particle size analysis technique. The desired properties of surface coating applications can be predicted by controlling various parameters mentioned in the fluid-droplet model.

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