

Abstract Submitted
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Phase Transformation of Droplets into Particles and Nucleation in Atmospheric Pressure Discharges¹ M.M. IQBAL, Dublin City University, C.P. STALLARD, D.P. DOWLING, University College Dublin, M.M. TURNER, Dublin City University — We investigate the mechanism of phase transformation of liquid precursor droplets into nano-particulates in an atmospheric pressure discharge (APD). This phase transformation is possible when the solid to a liquid mass ratio of slurry droplet reaches a threshold value. The behaviour of phase transformation of a single slurry droplet of HMDSO is described by developing a numerical model under the saturation condition of evaporation. It is observed from the temporal evolution of inner radius (R_i) of a single slurry droplet that its value approaches zero before the entire shifting of a liquid phase and which explains with an expansion in the crust thickness ($R_o - R_i$). The solid traces of nano-particles are observed experimentally on the surface coating depositions because the time for transferring the slurry droplet of HMDSO into solid state is amplified with an increment in the radii of droplets and the entire phase transition occurs within residence time for the nano-sized liquid droplets. The GDE coupled with discharge plasma is numerically solved to describe the mechanism of nucleation of nano-sized particles in APD plasma under similar conditions of the experiment. The growth of nucleation in APD plasma depends on the type of liquid precursor, such as HMDSO, TEOS and water, which is verified with a sharp peak in the nucleation rate and saturation ratio.

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