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Particle Emission Investigation from an Anode Liquid Surface of Electrolyte in Atmospheric Pressure DC Glow

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Self-organization patterns observed on anode liquid surfaces in atmospheric pressure DC glow discharge represents both a mysterious and beautiful plasma physics phenomenon. The mechanisms underlying self-organization of plasmas in this context is still poorly understood. In this study, luminous particle emission from the liquid anode under self-organization condition has been observed. These particles have been collected in flight using witness plates. The particle impacts have the form of splats suggesting that they are molten. The splats were observed to have a great deal of structure including evidence of nano-precipitation. These resulting splats were examined using a scanning electron microscope (SEM) and Energy-dispersive X-ray spectroscopy (EDX) diagnostics. In particular, the size range of molten particle droplets was theoretical estimated by converting from the size of impact splats. Furthermore, high-speed camera analysis was used to map the 2D trajectories of these particles in order to analyze both the emission force and the drag experienced by the particle during flight. This yields insight into mechanisms of emission. A thermal effect such as localized heating and evaporation is one potential mechanism driving the emission of particles that may be formed in the liquid. Here we examine the local temperature of the liquid water at the emission zone just below the surface. The actually temperature of this region is not well known and thus provides insight not only into the mechanisms of emission but also potentially the underlying processes driving the self-organization formation itself.

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