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Plasma-liquid interactions: towards a quantitative description of reactivity transfer?[1]

PETER BRUGGEMAN, Department of Mechanical Engineering, University of Minnesota, USA

The interaction of atmospheric pressure plasmas with liquid is a complex multiphase phenomenon. The transfer of the highly reactive chemistry produced in the gas-phase plasma to the bulk liquid phase enables many applications, including, water treatment and decontamination. While both gas and liquid phase chemistry have been studied separately in considerable detail, quantitative studies directly linking gas phase with liquid phase reactivity have been limited to modeling and lack experimental validation. We developed an experimental setup that eliminates many challenges related to complex fluid dynamics and allows studying plasma-liquid interactions. The setup consists of a diffuse glow discharge with a bulk uniform density of reactive species. A gas flow guides individual liquid micro-droplets produced by an on-demand droplet system through the plasma. This system allows the measurement of the gas phase reactive species densities and ex situ analysis of the collected droplets after plasma treatment. We will show preliminary results of the system that quantify the conversion of a model hydrocarbon compound in water. These results illustrate the capability of the setup to produce quantitative data on gas phase reactive species and liquid reactivity allowing validation of plasma-liquid interaction models.

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