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Simulations of Images and Optical Spectra of Plasmas Sustained in Bubbles in Water[1] WEI TIAN, MARK KUSHNER, University of Michigan — Plasmas in bubbles in water are being investigated for their ability to produce chemically reactive species for water purification and medical treatment. The gas in the bubbles is important to the production of these active species. In this paper, we report on a computational investigation of the dynamics of plasmas in bubbles in water. These simulations were performed using *nonPDPSIM*, in which Poisson's equation, transport equations for charged and neutral species, and electron temperature are integrated in 2-dimensions on an unstructured mesh. Bubbles of specified composition and size (≈3 mm diameter) in water at atmospheric pressure are placed at the tip of the powered electrode and water vapor is allowed to diffuse into the bubble from the vapor-water boundary. Voltage pulses (15-30 kV) produce plasma streamers in the bubble which typically hug the vapor-water boundary. Images, optical spectra and plasma properties will be discussed for bubbles of N_2, Ar and He, and compared to experiments [1]. The differences in plasma dynamics and appearance (e.g., volume discharge or surface hugging) depend in large part on the electron energy relaxation length, and the rate of diffusion of water vapor into the interior. Electron impact dissociative excitation of water vapor and excitation transfer processes from injected bubble gases to the water vapor are responsible for differences in the optical spectra and, by inference, differences in radical production.

[1] K. Tachibana, et al., Plasma Sources Sci. Technol. **20**, 034005 (2011).

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