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Plasma-induced Phase Transition of Water CHRISTOPHER CAMPBELL, XIN TANG, PENG XIAO, CHRISTOPHER LIMBACH, DAVID STAACK, Texas A&M University — Nanosecond-pulsed plasma processes in gases and liquids can generate local high-pressure high-temperature regions via rapid energy deposition, which can lead to near-isochoric heating. This effect is enhanced for pulsed plasma processes in liquid media, due to high molecular density. For water plasmas, the presence of these high pressures (potentially in the gigapascal range) suggests that the surrounding water may be undergoing local phase transitions to Ice VI or Ice VII. Due to the transient localized nature of the process and the presence of high electric fields, these phase transitions cannot be modeled fully using conventional thermodynamic methods. A single-electrode water corona setup was used to experimentally investigate this phenomenon. By triggering this corona event with a well-timed nanosecond power supply, it is possible to time the corona event of interest relative to a high-energy Nd:YAG nanosecond laser pulse, such that temporally-resolved Raman spectroscopy is possible. Because of its sensitivity to water's vibrational energy structure, Raman spectroscopy can be employed in the aforementioned setup to identify different phases of water during the corona event. Raman spectra and accompanying shadowgraph imaging is presented and discussed.

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