KINETICS OF HO_2 RADICAL IN NS PULSE O_2-He PLASMAS OVER A LIQUID WATER SURFACE AND UNDER ATMOSPHERIC PLASMA JET USING CAVITY RING DOWN SPECTROSCOPY

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Time-resolved, absolute HO_2 number density in O_2-He mixtures excited by a repetitive ns pulse discharge over a pool of distilled water and in atmospheric pressure plasma jets is measured in situ by Cavity Ringdown Spectroscopy (CRDS). The discharge cell with external electrodes to generate the plasma and a water reservoir are integrated into the CRDS cavity. The experimental results are obtained at near room temperature, both during the discharge pulse burst and in the afterglow. The HO_2 number density is inferred from the CRDS data using a spectral model exhibiting good agreement with previous measurements of absolute HO_2 absorption cross sections. HO_2 is generated during the discharge burst and decays in the afterglow between the bursts, on a ms time scale. Comparison with the kinetic modeling predictions demonstrates good agreement with the data and identifies the dominant HO_2 generation and decay processes. HO_2 in the plasma is formed predominantly by the recombination of H atoms, generated by the electron impact of water vapor, with O_2 molecules. Reactions with O atoms and OH radicals are among the main HO_2 decay processes in the afterglow. CRDS was also be used for HO_2 measurements in atmospheric pressure plasma jets, where the jet is integrated in the Open-air Cavity, the mirrors were protected with purge. The HO_2 number density is inferred from the CRDS data using a spectral model exhibiting good agreement with previous measurements of absolute HO_2 absorption cross sections.