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Vibrational Kinetics of Electronically Excited States in H2 Discharges

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The evolution of atmospheric pressure hydrogen plasma under the action of repetitively ns electrical pulse has been investigated using a 0D state-to-state kinetic model that self-consistently couples the master equation of heavy particles and the Boltzmann equation for free electrons. The kinetic model includes, together with atomic hydrogen states and the vibrational kinetics of H2 ground state, vibrational levels of singlet states, accounting for the collisional quenching, having a relevant role because of the high pressure. The mechanisms of excitations, radiative decay and collisional quenching involving the excited H2 states and the corresponding cross sections, integrated over the non-equilibrium eedf to obtain kinetic rates, are discussed in the light of the kinetic simulation results, i.e. the time evolution during the pulse of the plasma composition, of the eedf and of the vibrational distributions of ground and singlet excited states.

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