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Production and loss of rovibrationally excited H_2 molecules: Expanding Hydrogen plasmas in experiment and model RICHARD ENGELN, ONNO GABRIEL, DAAN SCHRAM, Eindhoven University of Technology, Eindhoven, The Netherlands, PETER VANKAN, Philips Lighting (CDL), Eindhoven, The Netherlands — The rovibrationally resolved density distributions of molecular hydrogen are measured in expanding thermal hydrogen plasmas by means of laser induced fluorescence in the vacuum-UV range (VUV-LIF). The results reveal a non-Boltzmann distributions, where the low rotational states (J = 1-6) follow a temperature of 700 K, while the higher rotational states are overpopulated compared to these lower states and follow higher temperatures up to 4500 K. Experiments were performed under variation of the surface area in the plasma source by varying the nozzle length. We assume surface association processes of atomic hydrogen at the surface of the nozzle, producing rovibrationally excited H_2 molecules. While the atomic hydrogen flow decreases with increasing surface areas, the H_2^{rv} distribution shows a more pronounced non-Boltzmann behaviour. A simple 0D model of (de)excitation processes by collisions with electrons and neutrals results in additional information about the formation of the measured H_2^{rv} distributions.

R.A.H. Engeln
Eindhoven University of Technology, Eindhoven, The Netherlands

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