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Time-Resolved Emission and Electrical Diagnosis of High Pressure H_2 and SiH_4/H_2 RF Discharges ELEFThERIOS AMANATIDES, DIMITRIOS MATARAS, Plasma Technology Lab., Dpt. of Chem. Engineering, University of Patras, PLASMA TECHNOLOGY LAB., DPT. OF CHEM. ENGINEERING, UNIVERSITY OF PATRAS TEAM — In the present work, we apply ultrafast spatially and temporally resolved emission spectroscopy together with electrical measurements in order to investigate elementary collision processes in SiH_4/H_2 RF discharges. Such plasmas operating above 1 Torr can deposit device grade $\mu\text{c-Si:H}$ films at high deposition rates even at the conventional frequency of 13.56 MHz. Short and long living excited species were monitored in order to study the variation of species production during the RF period for a pressure range of 1 to 10 Torr. These measurements were also correlated with the peaks of power deposition during the RF cycle. The results have shown that above 2.5 Torr plasma oscillates at double the excitation frequency and this was also identified by the significant enhancement of the current second harmonic. The production of excited species and their variation during the RF cycle were then related to the production of silicon hydrides radical and H atoms after taking into account differences in the collision frequencies of these processes. Finally, the spatial and temporal variations of species generation with pressure were correlated with the film deposition rate and structure and the changes on the growth mechanism are discussed.

Eleftherios Amanatides
Plasma Technology Lab., Dpt. of Chem. Engineering, University of Patras

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