SPECTROSCOPY AND DENSITY DETERMINATION OF THE SiH_2 RADICAL IN A DISCHARGE BY CAVITY RING–DOWN AND INTRA–CAVITY LASER ABSORPTION

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We have applied the new method of CW Cavity Ring Down Spectroscopy (CW-CRDS)[a] to the detection of transient species (SiH_2 and Ar^*) in a discharge. This is of interest for studying the gas phase and surface chemistries involved in the deposition of amorphous silicon from silane plasma. Doppler–limited absorption lines could be observed with high signal to noise ratio, belonging to the $\tilde{A}\,^1B_1(020) \leftarrow \tilde{X}\,^1A_1(000)$ transition around 580 nm. From an estimation of the transition strength, the concentrations of SiH_2 in the discharge could be evaluated to be on the order of $10^9/cm^3$. Keeping into account the signal to noise ratio, it results that concentrations as small as few times $10^7/cm^3$ can be detected by this method. After our demonstration[b] that CW-CRDS works well even with commercially available grating–tuned diode lasers, this becomes a very promising and affordable technique for plasma diagnostics. It is interesting to note that in our CRDS measurements we could also measure the continuum absorption due to small particles produced in the discharge.

In order to improve on the existing data, we reexamined extensively the SiH_2 spectrum using the technique of Intra Cavity Laser Absorption Spectroscopy (ICLAS). This method has about the same sensitivity as CRDS but a limited spectral resolution. However, ICLAS is a more efficient tool when large spectral intervals are to be explored. We will comment our new SiH_2 spectra and have a chance for a brief but direct comparison of the two absorption methods of CRDS and ICLAS.

[a] D. Romanini, A. A. Kachanov, N. Sadeghi, F. Stoeckel, Chem. Phys. Lett. 264 (1997) 316

[b] D. Romanini, A. A. Kachanov, F. Stoeckel, to be published in Chem. Phys. Lett.