

tube (length: 16.8 cm) ion mobility spectrometer with photoionization source (VUV Kr, 10.0/10.6 eV) was implemented in a pulsed laser induced fluorescence detection system. With this setup it was possible to investigate the dependence of the fluorescence intensity of selected PAH (continuous ion introduction) on the experimental parameters such as: PID-lamp current, ion gate voltage, electric field strength in the drift tube.

The fluorescence intensity was dependent on the PID lamp current. The rise of both the fluorescence intensity and the continuous ion current with the increase of the PID lamp current was observed. The simultaneous decrease of both the total ion current and the fluorescence intensity with the increase of the ion gate voltage was monitored. The generated by photoionization ions could be transported through the drift region and detected with the laser induced fluorescence monitoring system. The LIF signal intensities increased proportional to the drift field strength in the range of 157 – 265 V cm<sup>-1</sup>.

## Abstract

The coupling of ion mobility spectrometry (IMS) and laser-induced fluorescence spectroscopy (LIF) at atmospheric pressure was realized in this work. The construction of a module based drift tube enabled the use of different ionization techniques, as well as the implementation of a laser induced fluorescence detection system and a Faraday plate detector. With the analysis of the ionized dye Rhodamine 6G the system was characterized. For this, a “homemade” electrospray ionization source was used as ion source. At a distance of approximately 9 mm from the ESI tip to the drift tube entrance, a high desolvation rate of gaseous Rhodamine 6G was observed. The length of the drift tube was 3.2 cm. The drift time resolved laser induced fluorescence analysis of ions at ambient conditions on the example of dye Rhodamine 6G was investigated in a simplified IMS drift cell of open design.

Continuous wave radiation at a wavelength of 447 nm and 462 nm was used for excitation. The maxima of the fluorescence were observed at  $\lambda = 505$  nm. The drift time resolved fluorescence emission was monitored by a spectrograph in combination with a gated intensified charge coupled device.

The dependencies of Rhodamine 6G fluorescence intensities (continuous ion flow) on the electric fields of both the ion gate field and the drift field were determined at the exit of the 32 mm long drift cell. With increasing gate voltage, the signal intensity decreased. With an electrospray flow rate of  $300 \text{ nL min}^{-1}$  and a laser diode with 462 nm used as excitation source, a gate voltage of  $\geq 50$  V was required to block or deflect fluorescent ions of Rhodamine 6G in the drift cell. The increase of the fluorescence intensity was proportional to the electric field strength in the range of  $510 - 638 \text{ V cm}^{-1}$ .

Drift time dependent (pulsed ion flow) LIF analysis was performed under optimized conditions (462 nm, ESI flow rate  $300 \text{ nL min}^{-1}$ , gate voltage 80 V, ICCD integration time:  $100 \mu\text{s}$ ). The drift time spectra produced with both, the Faraday plate detector and the laser induced fluorescence detector showed the same trends. Significantly smaller FWHM were found with the LIF detector as compared to that found with the electrometer.

Based on the findings of the experiments with Rhodamine 6G, the experimental setup for PAH analysis was designed and developed. A unidirectional flow, closed, heated (up to  $200^\circ \text{C}$ ) drift