

observed in emission in astronomical sources. To investigate the case, we have recorded IR spectra of other organometallics. A discussion of these spectra will be presented together with their relevance to astronomical data.

Experimental studies of reactions of neutral and ionized PAHs

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Polycyclic Aromatic Hydrocarbon (PAH) molecules have been postulated as the carriers of the unidentified infrared features [1,2] as well as of the visible absorption bands [3,4] that are observed in interstellar and circumstellar environments. A more recent study led to the suggestion that small PAH's are mostly responsible for the infra-red emission [5].

Very few experimental data are presently available on the reactions of neutral or ionized PAH's [6,7]. We performed measurements of dissociative recombination, electron attachment and ion-molecule reaction rates with naphthalene, anthracene and phenanthrene using the FALP-MS (Flowing Afterglow Langmuir Probe-Mass Spectrometer) apparatus. One of the major difficulties of the experiment is to inject the PAH as a gas into the flow, and to control its flow rate precisely.

It appeared that anthracene on one hand and naphthalene and phenanthrene on the other have completely different behaviours concerning electron attachment: naphthalene and phenanthrene do not attach as anthracene does. A value of $9 \cdot 10^{-10} \text{ cm}^3\text{s}^{-1}$ has been measured for anthracene, indicating that an activation barrier may exist.

When attachment is important, it becomes difficult to measure dissociative recombination rates because two different sinks for the electron compete. Anyway an order of magnitude for the dissociative recombination of anthracene can be evaluated at $2 \cdot 10^{-6} \text{ cm}^3\text{s}^{-1}$. For naphthalene and phenanthrene, the rates are $3 \cdot 10^{-7} \text{ cm}^3\text{s}^{-1}$ and $7 \cdot 10^{-7} \text{ cm}^3\text{s}^{-1}$ respectively.

The reactions of He^+ and C^+ with PAHs are fast and close to the Langevin rate. Fragmentation of the PAH can be observed in both cases, but is more severe with He^+ than with C^+ , and aggregates can form from the ionized products.

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Photofragmentation of isolated PAH cations: direct determination of the oscillator strengths

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Using an ion trap based on the technique of the ionic cyclotronic resonance (ICR) cell, we have studied the photofragmentation of PAH cations induced by the irradiation of a xenon arc lamp.

Owing to the absence of collisions in the trap, radiative energy exchanges can only occur. Under these conditions, fragmentation of anthracene cations ($\text{C}_{14}\text{H}_{10}^+$) has been obtained with continuous irradiation at wavelengths longer than 590 nm, i.e. with photons of energy lower than 2.1 eV. This fragmentation can be explained as the result of a gradual increase in internal energy due to multiple photon absorptions.