Stability of dimer and trimer of Naphthalene studied in electrostatic storage Mini-Ring.

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Synopsis We report studies on stabilities of dimer and trimer of polycyclic aromatic hydrocarbon PAH in a small electrostatic storage device. Different nslaser energies were used at different time delays as the probe to determine the dissociation energy. The effect of dehydrogenation on the stability is also studied.

We present measurements on the stabilities of the dimer and trimer of PAH studied with the MINIRING [1]. Stabilities of Dimer-nH (n=1-4) of Naphthalene are also studied.

Dimer and Trimer cations of PAH were produced on the Nanogan ECR (Electron Cyclotron Resonance) ions source and accelerated up to 12 keV. The production of dimers and dehydrogenated dimers of Naphthalene was strongly depending on the source conditions such as injected naphtalene gas pressure and the 10 GHz HF power. Typically a 10^{-5} mbar pressure and 0.6W HF power were used to produce intact dimers. Lower pressure promoted dehydrogenated dimers. The studied molecules were stored in the electrostatic storage ring "Mini-Ring" for up to 100 ms. "Natural" decays were studied by measuring the neutral fragments emitted by the stored molecules. A position sensitive de-tector was used to measure the position and time of the neutral fragment emitted at each turn. For the intact dimer of naphthalene, we observed a small spot on the multichannel plate indicating a small Kinetic Energy Release (KER) of the fragmentation reaction. This is in good agreement with a "Van Der Waals" bind-ing leading to a fragmentation of the dimers in two monomers . In contrast, the dehydrogenat-ed dimer shows a broad spot indicating the emission of a small fragment (H or C_2H_2) by a "quasi covalent" dimer. Natural decays (e.g., figure 1) and decays induced by the laser were also studied. Simulations for the intact dimer of naphthalene using a simple RRKM model are in good agreement with experimental decays. The cooling measurements of the dimers and trimers of napthalene will also be presented.

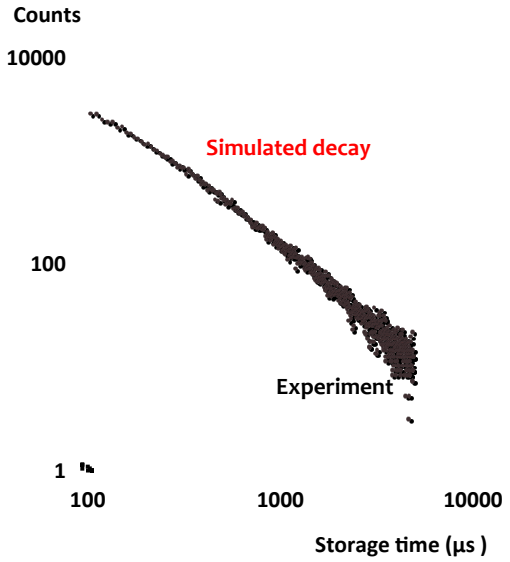


Figure 1. Experimental and simulated decays for dimer-Naphthalene using low dissociation energy of 0.7 eV. This measurement is in agreement with the Van der Waals nature of the binding of the dimer of Naphthalene.

References

[1] S. Martin *et al* 2013 *Phys. Rev. Lett.* **110** 063003

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