

IDENTIFICATION OF PHOTOFRAGMENTS FROM ONE-COLOR RESONANTLY-ENHANCED ($\tilde{A} - \tilde{X}$) MULTI-PHOTON PHOTODISSOCIATION OF ACETYLENE

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One-color (212-220 nm) multi-photon photodissociation of acetylene, resonantly enhanced by the $\tilde{A}(S_1) - \tilde{X}$ transition, gives rise to strong photofragment fluorescence signals in the visible and near UV regions. In this work, fluorescence signals from the photofragments, generated with three intermediate S_1 levels (*trans* 3^4 , *trans* 3^5 , and *cis* 3^16^1), are studied, both in the flow cell and supersonic jet conditions. In the flow cell (~ 3 torr), the dispersed fluorescence (DF) spectra of the photofragments are obtained. For all three S_1 levels, we observe C_2 Swan band ($d^3\Pi_g - a^3\Pi_u$) and C_2 Deslandres-d'Azambuja band ($C^1\Pi_g - A^1\Pi_u$) emissions, with the former approximately four times more intense than the latter. In the supersonic jet condition (collision-free), fluorescence time-traces at selected wavelength regions are analyzed. We confirm the presence of the two C_2 emission bands and their relative intensity observed in the DF spectra. In the supersonic jet condition, we also observe long lifetime visible fluorescence signal ($> 3 \mu s$ lifetime), which is likely due to emissions from C_2H fragment, based on previous vacuum UV photolysis studies of acetylene. The photodissociation mechanism is inferred, based on our analysis of the flow cell DF spectra and the fluorescence time-traces obtained in the supersonic jet condition. The C_2H fragment is likely generated from one-photon photodissociation of S_1 acetylene, and an additional photon dissociates the C_2H fragment into the C_2 C and d states.