

## LIFETIMES OF THE $\tilde{A}$ STATES OF $C_3$ , $C_3$ -NE, AND $C_3$ -AR

YI-JEN WANG, CHIAO-WEI CHEN, LIUZHU ZHOU, ANTHONY J. MERER, YEN-CHU HSU, *Institute of Atomic and Molecular Sciences, Academia Sinica, P. O. Box 23-166, Taipei 10617, Taiwan, R. O. C.*

The fluorescence lifetimes of the  $\tilde{A}$  states of  $C_3$ ,  $C_3$ -Ne and  $C_3$ -Ar have been measured under supersonic molecular beam conditions. To minimize possible collisional quenching, the lifetimes of all three species were measured at a distance of about 42 nozzle diameters from the orifice. For all the vibrational levels of the  $\tilde{A}$  state of the  $C_3$  monomer, only  $J'=1$  lifetimes were recorded, using R(0) lines. The accuracy of the lifetimes obtained was estimated to be better than 3ns. General features of the lifetimes of the  $C_3$  monomer are as follows: with increasing excitation of the symmetric stretching vibration, the lifetimes increase to a maximum at  $v_1=4$ . Bending excitation reduces the lifetimes, though exceptions occur for the  $0\ v\ 0$  and  $1\ v\ 0$  levels. Among all the vibrational levels,  $0\ 2^-\ 0$ ,  $0\ 4^-\ 0$ , and  $0\ 2^+\ 0$  have the shortest lifetimes, similar to that of the origin level<sup>a</sup>. Lifetimes of the  $\tilde{A}$  state of  $C_3$ -Ne and  $C_3$ -Ar have only been measured for features 1.5-2 and 11-14  $\text{cm}^{-1}$ , respectively, to the red of the R(0) lines of the  $\tilde{A}-\tilde{X}$  bands of free  $C_3$ . It is not possible to reduce the backing pressure while measuring lifetimes of the complexes; we therefore reduced the average pressure of the chamber to  $1\text{-}2\times 10^{-5}$  torr by lowering the repetition rate. No sign of predissociation was found in the Ne complex except for the level  $0\ 12^+\ 0$ . The lifetimes of the complexes did not vary with vibration in the manner found for  $C_3$  itself. The lifetime of the  $0\ 2^-\ 0$  level, one of the lowest vibrational levels of the  $\tilde{A}$  state, was not affected by complexing with either Ne or Ar, consistent with the observation that the least van der Waals shifts were observed for this vibrational level<sup>b</sup>.

<sup>a</sup>G. Zhang, K.-S. Chen, A. J. Merer, Y.-C. Hsu, W.-J. Chen, S. Shaji, and Y.-A. Liao, J. Chem. Phys. 122, 244308 (2005).

<sup>b</sup>G. Zhang, B.-G. Lin, S.-M. Wen, and Y.-C. Hsu, J. Chem. Phys. 120, 3189 (2004).