

THE PHOTOIONIZATION SPECTROSCOPY OF THE ZINC MONOETHYL RADICAL AND ITS POSITIVE ION

MICHAEL B. PUSHKARSKY, VADIM L. STAKHURSKY, AND TERRY A. MILLER, *The Ohio State University, Dept. of Chemistry, Laser Spectroscopy Facility, 120 W. 18th Avenue, Columbus, Ohio 43210.*

The high resolution spectroscopy of many closed-shell ions has for years been relatively inaccessible. However, ZEKE spectroscopy applied to open-shell radicals produced *in situ* in free jets enables one to probe the ground electronic state of the corresponding closed-shell ions. In the recent past we have investigated^{a,b} the 1A_1 ground electronic state of the cations of three Group IIa and IIb organometallic radicals, MCH_3 , (M=Mg, Zn, Cd). In this talk we will present the spectroscopic study of the zinc monoethyl radical, and its positive ion. ZnC_2H_5 has been produced *in situ* in a free jet by laser photolysis of $Zn(C_2H_5)_2$. The vibrational structure of the \tilde{A} electronic state of the zinc monoethyl radical and the \tilde{X} state of its cation have been probed by $(1+1')$ REMPI and ZEKE, respectively. The REMPI spectrum is nearly identical with the previously reported^c LIF spectrum. The zinc monoethyl ionization potential has been found to be $56380(5) \text{ cm}^{-1}$. The ZEKE study has revealed complex vibrational structure in the ground electronic state of the ion, dominated by progressions involving ν_9 , ($\omega_9 = 210(3) \text{ cm}^{-1}$), the low frequency in-plane Zn-C-C bending mode. The details of the cation's vibrational assignment will be given. Implications of our observations for the carbon-metal bonding in the metal alkyl radical molecular systems will be discussed.

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^bT. A. Barckholtz, D. E. Powers, T. A. Miller, and B. E. Bursten, *J. Am. Chem. Soc.*, **121**, XXXX (April, 1999).

^cI. M. Povey, A. J. Bezzant, G. K. Corlett, and A. M. Ellis, *J. Phys. Chem.*, **98**, 10427 (1994).