

## ACTIVATION OF C-H BONDS: PURE ROTATIONAL SPECTROSCOPY OF $\text{HZnCH}_3$ ( $\tilde{X}^1A_1$ )

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The pure rotational spectrum of  $\text{HZnCH}_3$  has been observed in its ground electronic state ( $\tilde{X}^1A_1$ ) using both direct absorption and Fourier transform microwave techniques in the frequency range 18-516 GHz. Twelve rotational transitions of this symmetric top species were recorded in K-ladders up to  $K = 7$ . The molecule was synthesized from  $\text{Zn}(\text{CH}_3)_2$  in an AC discharge and also from Zn (vapor) +  $\text{CH}_4$  with a DC discharge. From measurements of the spectra of various isotopic species ( $^{66}\text{Zn}$ ,  $^{67}\text{Zn}$ ,  $^{68}\text{Zn}$ ,  $^{13}\text{C}$ , and  $^2\text{H}$ ), an accurate structure has been determined. The H-C-H bond angle was found to be  $108.7^\circ$ , slightly smaller than that in  $\text{ZnCH}_3$  or  $\text{CH}_4$ . In addition, nuclear spin-rotation ( $I \cdot J$ ) interactions with the methyl hydrogen nuclei and electric quadrupole coupling from the  $^{67}\text{Zn}$  nucleus were resolved in the FTMW spectrum. From these data, hyperfine parameters have been established. The value of  $eqQ = -109.125(11)$  MHz indicates that the bonds to zinc are primarily covalent. Detection of this species, especially via the  $\text{Zn} + \text{CH}_4$  pathway, is a good indication of the ability of metal atoms to insert into C-H bonds.