

INFRARED SPECTROSCOPY OF $M^+(\text{CH}_4)_n(\text{H}_2\text{O})_{3-4}$ CLUSTERS (M=Li, Na): INDUCING $\text{H}_2\text{O}\cdots\text{H}_2\text{O}$ AND $\text{H}_2\text{O}\cdots\text{CH}_4$ HYDROGEN BONDS IN METHANATED CLUSTERS

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Experiments on $M^+(\text{CH}_4)_n(\text{H}_2\text{O})_{3-4}$ (M=Li and Na) have been carried out using tandem mass spectrometry and infrared spectroscopy in the O-H stretching region from 3400 cm^{-1} to 3800 cm^{-1} . We have found, for example, that a single CH_4 can induce hydrogen bonded conformers in the cases of $\text{Li}^+(\text{CH}_4)_1(\text{H}_2\text{O})_3\text{Ar}_{0-1}$, which are absent in the $\text{Li}^+(\text{H}_2\text{O})_3\text{Ar}_{0-1}$ spectra^{a,b}. Furthermore, upon addition of multiple CH_4 ligands, hydrogen bonding is not only maintained, but features associated with $\text{H}_2\text{O}\cdots\text{CH}_4$ hydrogen bonds are more intense, indicating the affinity of CH_4 to bind to available O-H sites. Spectra of $\text{Li}^+(\text{CH}_4)_{1-3}(\text{H}_2\text{O})_4$ and $\text{Na}^+(\text{CH}_4)_{1-3}(\text{H}_2\text{O})_{3-4}$ clusters will also be discussed, all of which exhibit the curious trait of $\text{H}_2\text{O}\cdots\text{H}_2\text{O}$ and $\text{H}_2\text{O}\cdots\text{CH}_4$ hydrogen bonding in the presence of hydrophobic, non-polar CH_4 . To better understand the nature and onset of $\text{H}_2\text{O}\cdots\text{CH}_4$ hydrogen bonding, the $\text{Li}^+(\text{CH}_4)_n(\text{H}_2\text{O})_{1-2}$ spectra will be discussed.

^aD.J. Miller and J.M. Lisy *J. Am. Chem. Soc.* **130**, 15381 (2008).

^bD.J. Miller and J.M. Lisy *J. Am. Chem. Soc.* **130**, 15393 (2008).