INFRARED PHOTODISSOCIATION SPECTROSCOPY OF PROTONATED METHANOL CLUSTER IONS

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Photodissociation spectra of the protonated methanol cluster ions, $H^+(CH_3OH)_n$ ($n = 4-8$), were measured in the range of $900-2300$ cm^{-1} by using a infrared free electron laser. A broad spectral feature was observed at about 1600 cm^{-1} in each spectrum. We assign this feature to the OH^+ stretching vibration, which is coupled with the OH bending motion in the HOH^+ group. The small vibrational wavenumber suggests that the O-H^+ bond is very weak.
Structure optimizations by the density functional theory show that H^+ is equally shared by two oxygen atoms at $n = 4, 5$. This result also demonstrates the weak bonding between H^+ and oxygen. The binding features of H^+ in the cluster ions will be discussed.