

DIRECT OBSERVATION OF IR INDUCED ISOMERIZATIONS OF HYDROGEN-BONDED PHENOL CLUSTER CATIONS

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Since gas-phase hydrogen-bonded clusters are treated as microscopic models of hydrogen bond networks, numerous spectroscopic studies have been performed, so far. Structural fluctuations are one of features of hydrogen bond network. Such fluctuations correspond to isomerizations among isomers having distinct hydrogen bond structures in the cases of clusters. To investigate microscopic natures of structural fluctuations of hydrogen bond networks, we observed IR-induced isomerizations of hydrogen-bonded phenol cluster cations trapped in a cold ion trap. In a cold condition, all hydrogen-bonded phenol-methanol cluster cations $[\text{PhOH}(\text{MeOH})_3]^+$ have a ring type hydrogen bond structures. In contrast, isomers having a chain type hydrogen bond structure are dominant in a hot condition. In the present experiment, we excited the ring isomers in a cold condition by IR laser pulses. Since the energy of IR laser photon exceeded the height of isomerization barriers, isomerizations from the ring to chain isomers occurred. We successfully detected the chain type isomers in ultraviolet photodissociation spectra. Additionally, we also observed reverse isomerizations from the chain back to the ring isomers by the collisional cooling with the buffer gas. Details of the observations are presented in the paper.