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Single-molecule vibrational spectroscopy of water molecules using an LT-STM CHIKAKO MATSUMOTO, Gakushuin Univ., RIKEN, YOUSOO KIM, RIKEN, KENTA MOTOBAYASHI, Univ. of Tokyo, MAKI KAWAI, Univ. of Tokyo, RIKEN — Single-molecule vibrational spectroscopy has attracted considerable attention as a powerful tool for nanoscale chemistry. The adsorption of water molecules on metal surfaces plays an important role in understanding many phenomena in nature, such as heterogeneous catalysis and corrosion, etc. The structure of water at low coverage has been investigated on a variety of transition-metal surfaces with various techniques. But the microscopic understanding of the adsorption feature of single water molecules is still unclear. We report molecular scale study of adsorption behaviors of water molecules on Pt (111) surface at 4.7 K by use of single-molecule vibrational spectroscopy with the scanning tunneling microscopy (STM). The Pt (111) surface was dosed with a small amount of water molecules ($<$ 0.01 ML) at the temperature less than 20 K. A water monomer appears as a single protrusion in the STM images. A dimer was formed by manipulating monomers with an STM tip. The shape of a water dimer looks like 'cherry blossom', which can be explained by one of the water molecules rotating around the other. Inelastic electron tunneling spectroscopy using the STM was utilized to determine vibrational modes of individual water dimers.

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