# Mode-selective and state-selective chemistry of a single molecule with tunneling electrons

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The study of single molecules provides deep insights into bonding nature and underlying quantum mechanics concerning about controlling chemical reaction. The scanning tunneling microscope (STM) is a versatile and powerful tool for investigating and controlling chemistry of individual molecules on the solid surfaces. The coupling of tunneling electrons to the electronic and vibrational states of the target molecule allows us to realize mode-selective and state-selective chemistry of the individual molecules.
In this talk, I will address two main issues with our experimental and theoretical efforts on investigating interaction of electrons with vibrational and electronic states of a single molecule on the surfaces. The first part is assigned to the excitation of vibrational modes to selectively induce particular dynamic motion [1-5] and chemical reaction [4,6] of a single molecule on the metal surfaces. The microscopic mechanism of vibrationally induced molecular motions [2,4] and the selection rules for the single-molecule vibrational spectroscopy [4,7] are also discussed. The second part focuses on the selective control of reaction pathways by use of long lifetime of vibrationally and electronically excited states of a molecule on an insulating thin metal oxide layer [8-10].

References

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