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A cryogen-free variable temperature scanning tunneling microscope capable for inelastic electron tunneling spectroscopy SHUAI ZHANG, DI HUANG, SHIWEI WU, Fudan University — While low temperature scanning tunneling microscope (STM) has become an indispensable research tool in surface science, its versatility is yet limited by the shortage or high cost of liquid helium. The makeshifts include the use of alternative cryogen (such as liquid nitrogen) at higher temperature or the development of helium liquefier system usually at departmental or campus wide. The ultimate solution would be the direct integration of a cryogen-free cryocooler based on GM or pulse tube closed cycle in the STM itself. However, the nasty mechanical vibration at low frequency intrinsic to cryocoolers has set the biggest obstacle because of the known challenges in vibration isolation required to high performance of STM. In this talk, we will present the design and performance of our home-built cryogen-free variable temperature STM at Fudan University. This system can obtain atomically sharp STM images and high resolution dI/dV spectra comparable to state-of-the-art low temperature STMs, but with no limitation on running hours. Moreover, we demonstrated the inelastic tunneling spectroscopy (STM-IETS) on a single CO molecule with a cryogen-free STM for the first time.

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