

## **Scanning tunneling microscopy imaging in cryogenic liquids and fabrication of nanoscale structures**

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A description will be given of a scanning tunneling microscope (STM) device capable of imaging in vacuum, gases and cryogenic liquids and experiments on the fabrication of nanostructures using the device. The STM has an external Dewar type cooling system based on pressure controlled liquid nitrogen with a temperature control range of roughly 85 K to 110 K chosen to suit triple points of several gases including argon and methane which can therefore be liquified. The cooling system surrounds the STM so its temperature is uniform and stable. The strength of the STM lies in its stability and it has been used for atomic resolution imaging of graphite submerged in a methane liquid at a temperature of 100 K and a vapor pressure of 0.37 bar.

An STM can be used for altering the shape of surfaces as well as imaging them. After the alteration the STM can then be used to image the changes on the surface. Experiments on the fabrication of nanostructures on metal surfaces by applying pulses of varying voltage between the surface and the tip of the STM for different distances between them will be described. After the nanofabrication the tip of the STM is used to image the results. Nanofabrication experiments were performed on palladium and titaniumnitride surfaces in vacuum and argon and methane gases using tungsten STM tips at room temperature.