

A novel scanning tunneling microscope with an interchangeable cell and external actuators

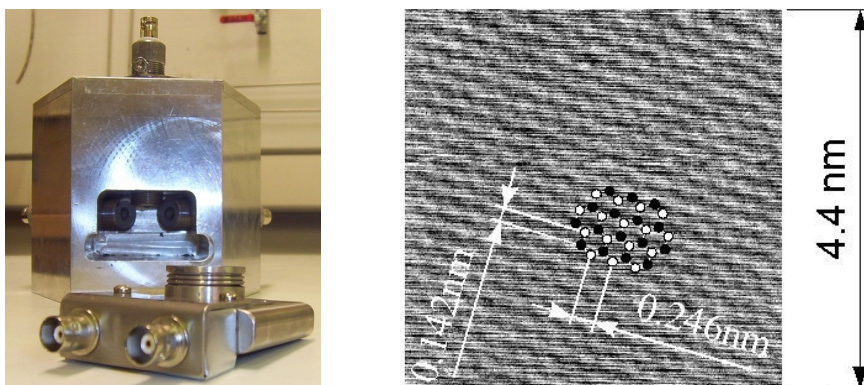
Elias H. Bjarnason^{a,*}, *Unnar B. Arnalds*^a, *Sveinn Olafsson*^b

^a Matvice, Dunhaga 3, 107 Reykjavik, Iceland

^b Science Institute, University of Iceland, Dunhaga 3, 107 Reykjavik, Iceland

Abstract

A novel scanning tunneling microscope (STM) has been designed and built. The second of two in Iceland. A tip and sample are located inside an interchangeable cell. The cell consists of a stiff top-plate and a bottom-plate, fastened together by an elastic and deformable part. The cell bottom-part, containing a scanning tip, is fastened to a base unit while the top plate, containing a sample, is capable of displacements. Three (x,y,z) piezoelectric actuators inside the base unit control the tip-sample distance and the (x,y) scanning operations. The device stability increases considerably when the piezoelectric actuators apply a compression to the cell previous to operation. A frequency characterization and computer calculations are presented showing the systems stability. An image scan showing atomic resolution of highly oriented graphite in air, at room temperature, is also presented. This design is expected to simplify the scanning tunneling microscope operation in difficult environments greatly by enclosing only the tip and sample in a small cell-module, which is pluggable to a scanning mechanism and other supportive functionalities. A new, more complex, STM is being developed, based on this design concept and is intended for operation in ultra high vacuum and cryogenic environment where clean and stable conditions are enabled for nanoscale processing on surfaces.



The STM that was built and a graphite surface in atomic resolution.

* Corresponding author.

E-mail address: ehb@raunvis.hi.is (E.H. Bjarnason).