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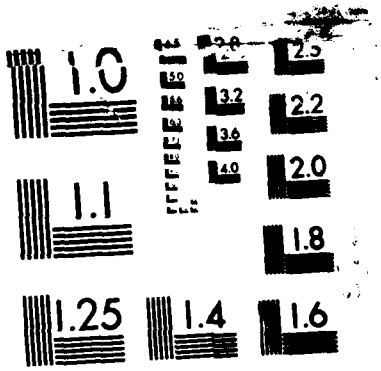

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FINAL TECHNICAL REPORT
ONR CONTRACT NO. N00014-89-K-0638
ELECTRON TUNNELING MICROSCOPY
By

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Within the past few years a new technique for surface studies has been introduced by researchers at the IBM Research Laboratory in Zurich, Switzerland which is capable of atomic resolution. This method, called Scanning Tunneling Microscopy (STM), involves positioning a probe a few angstroms from the surface of interest using a piezoelectric ceramic. A small potential is applied across the gap and the electron tunneling current is measured. The probing tip is then scanned across the surface in two dimensions also using piezoelectric ceramics while adjusting the distance between the tip and surface to maintain a constant current. In this way the tip is made to follow the contours of the surface. The resolution obtained in this way is about 3 A in the surface plane, and 0.1 A normal to the surface.

The development of an STM at Caltech is well underway, based on the design pioneered by the IBM Research Group in Zurich. Electron Tunneling has been demonstrated, and preliminary surface images of gold films have been obtained. Additional instrumental development is required to achieve the atomic resolution which is required for the study of chemical processes on surfaces. A theoretical model has also been developed for the tunneling of electrons from the probe to surfaces with molecular species adsorbed, and with atomic and molecular species intervening between the probe and the surface. The progress of both experimental and theoretical developments at Caltech is described in a manuscript which has been accepted for publication in the IBM Journal of Research and Development.[1]

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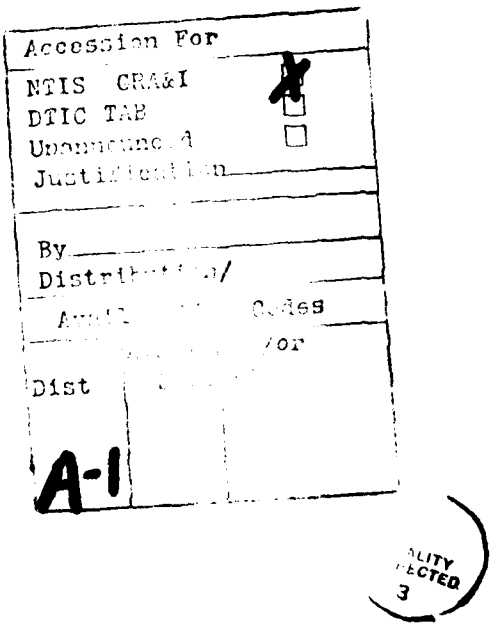
1. David V. Baxter; Robert J. Cave; John E. Kramar; Paul E.West; John D. Baldeschwieler, IBM J. of Research and Development 1985, submitted. Chemical Applications of Scanning Tunneling Microscopy.



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