

Thermal expansion of scanning tunneling microscopy tips under laser illumination

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The periodic thermal expansion of scanning tunneling microscopy ~STM! tips arising under irradiation with power-modulated laser light has been investigated. The expansion was determined by comparison with a calibrated piezomotion measured in an STM, which was operated in the constant-current mode, and instrumental effects were corrected for. The experimental data concerning the frequency response of the thermal expansion for various geometries of the tip and for different positions of the laser focus are compared with theoretical results which were derived from a numerical solution of the equation of heat conduction. A very good agreement is found. The results are also interpreted in terms of simplified analytical expressions. Furthermore, the theoretical data are used to derive the response of the tip to fast transients of the light power as in the case of pulsed irradiation.