Field Emission from a Nanomechanical Pillar

HYUN KIM, HUA QIN, ROBERT BLICK, Laboratory for Molecular Scale Engineering, Electrical and Computer Engineering, University of Wisconsin-Madison, MICHAEL WESTPHALL, LLOYD SMITH, Department of Chemistry, University of Wisconsin-Madison — We have measured the field emission in a nano-electromechanical structure in which a nanometre silicon pillar oscillates in between the source and drain electrodes. The device consists of a mechanically flexible pillar with a length of some 200 nm and a diameter of some 50 nm and allows for mechanical resonant excitations at radio frequencies (10 \textasciitilde 1000 MHz) and mechanical clocking of the field emitted electrons. Operation of the device at room temperature in the frequency range of 300 \textasciitilde 400 MHz is presented. For AC and DC drive, the current shows a rich frequency dependent response. A modified Fowler-Nordheim field emission curve is observed and attributed to the effect of oscillating pillar excited by an alternating electric field.

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