

基于MEMS的微位移传感器及其应用研究

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摘要:

对一种基于MEMS探针进行开发, 以实现微纳米尺度下的几何量测量。该探针是静电梳齿型结构, 含有定齿和连接有主梁的动齿。主梁顶端的探针能够感知样品表面形貌而引起梳齿间位移, 梳齿间位移能够带来梳齿间电容的变化。设计了测头的电容信号检测电路。搭建测试系统, 利用该系统进行进针实验, 标定测头的灵敏度为2.323nm/mV, 实验表明测头的非线性误差小于0.22%。利用该测头作为SPM测头, 搭建小型SPM系统, 对108nm台阶高度的光栅结构进行了扫描。

关键词: MEMS位移传感器; 静电梳齿结构; 微扫描探针测头; SPM应用

MEMS based micro displacement sensor and its application

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Abstract:

A micro displacement sensor based on MEMS(micro-electro-mechanical system) technology was developed for the micro-nano dimensional measurement as a SPM(scanning probe microscopy) head. This kind of electrostatic comb-drive structure consists of two interdigitated finger structures. One kind of fingers is fixed and the other is movable. A main shaft connected with the movable comb structures senses the surface displacement, which could generate a capacitance variation between the fixed and movable fingers. A signal detection circuit was conceived to convert the capacitance variation to the voltage variation. An experiment system was constructed. Approach test was carried out to calibrate the sensitivity of the head as 2.32nm/mV. Experiment results indicate that the non-linearity error of the SPM head is less than 0.22%. The z axis measurement range of the SPM head is 10 μ m. An SPM system including the SPM head is constructed to measure a grating structure which step height is 108nm.

Keywords: MEMS displacement sensor; electrostatic comb-drive structure; micro-SPM head; SPM application

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