Integrating MEMS Electro-Static Driven Micro-Probe and Laser Doppler Vibrometer for Non-Contact Vibration Mode SPM System Design

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Abstract

This research integrated a MEMS electrostatic driven micro-probe and a laser Doppler vibrometer for non-contact vibration mode scanning probe microscope system design. The microprobe tip was placed in perpendicular to the sample surface, and the built-in capacitor on the microprobe was excited to vibrate by a sinusoidal drive voltage to generate Coulomb electrostatic force. The applied frequency is right at the structure natural resonant frequency of the microprobe. Then let the sample carried by a Z-stage move up. When the sample gets closer to the microprobe, the Van Der Waal’s force between the sample and microprobe would become larger, and the microprobe vibration amplitude would be reduced, and which can be determined by a laser Doppler vibrometer. Since the probe vibration amplitude is proportion to the distance between the probe tip and the sample surface. Thus one can detect the sample surface profile, by moving the probe tip at a constant height, and using a laser Doppler vibrometer to obtain the topography with the amplitudes of microprobe vibration history. The accuracy of the proposed system is about 10 nanometers with a gauge meter.

Keyword：Microprobe, Non-Contact Vibration Mode, Scanning Probe Microscope