

Non-Contact Mode SPM System Design with MEMS Micro-Cantilever Probe

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Abstract

This research integrated a MEMS electrostatic driven microprobe 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. Thus this kind of electrostatic driven microprobe is not proposed in previous literatures [1-3]. The applied frequency is right at the structure natural resonant frequency of 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 probe tip and sample surface. Thus one can detect sample surface profile, by moving probe tip at a constant height, and using a laser Doppler vibrometer to obtain topography with the amplitudes of microprobe vibration history. The accuracy of the proposed system is about 10 nanometers.

Keyword : SPM. MEMS. Non-Contact. laser Doppler vibrometer