Accurate micron-scale modification of AFM cantilevers

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(i) Introduction

Atomic force microscopy (AFM) has provided the modern researcher with the ability to perform accurate force measurements between a probe and a surface. The data obtained can be used in the development of biosensors, surfactants, and materials with enhanced properties, to name only a few applications. The atomic force microscope (AFM) is undoubtedly suited for making repeated force measurements. Standard AFM cantilevers can be modified through the attachment of a colloid probe such as silica, and employed in the analysis of forces between surfaces.

(ii) Previous method and limitations

Resin-based or glass bond adhesives are suitable for probe bonding, as they are insoluble in water once set. However, such adhesives often require heating to reduce their viscosity, which makes the procedure quite difficult to carry out. The particle is usually attached to the apex of the cantilever, so that measurements can be performed with optimum force resolution. Particle attachment is traditionally carried out under an optical microscope using thin wire as a guide. However, there is no guarantee that the colloid particle has been accurately positioned on the apex of the cantilever.

This does not require the use of elevated temperatures and also offers excellent chemical resistivity against wates acids, and some organic solvents. The AFM was used to attach a 6.62 μm diameter colloidal silica particle (Bangs Labs) to the apex of the AFM cantilever using UV curable adhesive. The following figures are video camera images from the AFM (left-hand side) and cartoon representations (right-hand side), showing the procedure as it was performed.

(v) Conclusion

The Dimension 3100 Nanoscope AFM has successfully been used to modify an AFM cantilever with a colloidal silica particle, using UV curable adhesive as a bonding agent. The procedure is easily repeatable and can be performed relatively quickly. Moreover, when surface interactions are performed, the measurements will have optimal force resolution, due to the accurate positioning of the particle at the apex of the cantilever. This is a definite advantage over the use of an optical microscope for cantilever modification.

(vi) References