Mechanical behavior of micro/nano piezoelectric cantilever induced by adsorption

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ABSTRACT

Microcantilever-based techniques can be used to explore surface stress and infinitesimal mass, which are induced by the adsorbed atoms/molecules on its surface. These microcantilever sensors can be operated in two different operational modes of static and dynamic. In the static mode, the cantilever deflection is measured which relates to the adsorption-induced surface stress. In the dynamic operational mode, adsorption-induced surface stress together with the adsorbed mass can change the resonance frequency of the cantilever. An energy-based theoretical model is developed to investigate the bending deformation and resonance frequency of micro-nano piezoelectric cantilever induced by adsorption. The residual surface stress, surface elasticity and surface piezoelectricity are incorporated in the model. This study is helpful for optimized design of piezoelectric microcantilever-based devices for various applications.