

Strain Dependence of Adatoms and Adatom Clusters on a Substrate Surface

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Abstract

Experimental techniques are now available to measure changes in surface stress due to submonolayer coverages of adatoms on a substrate. It is shown that such measurements point to a strain dependence in adatom-adatom interactions. A continuum-level point-defect model of adatoms with strain-dependent properties is developed and direct links are established with both atomistic and macroscopic continuum models. Relations are obtained for extracting constitutive constants of an adatom from both atomistic calculations and experimental measurements of surface stress versus adatom coverage. The model demonstrates that applied strain might provide some control over adatom interactions to self-assemble certain nanostructures. By studying the long-range pair interaction between adatoms, it is found that strain can cause adatom pairs to align themselves in particular directions and modulate their interaction between repulsion and attraction.