abstract

There is an inexorable link between structure and stress, both of which require study in order to truly understand the physics of thin films. To further our knowledge of thin films, the relationship between structure and stress development was examined in three separate systems in vacuum. The first was continued copper thin film growth in ultrahigh vacuum after adsorption of a submonolayer quantity of oxygen. Results showed an increase in compressive stress generation, and theory was proposed to explain the additional compressive stress within the films. The second system explored was the adsorption of carbon monoxide on the platinum \{111\} surface in vacuum. The experiments displayed a correlation between known structural developments in the adsorbed carbon monoxide adlayer and the surface stress state of the system. The third system consisted of the growth and annealing stresses of ice thin films at cryogenic temperatures in vacuum. It was shown that the growth stresses are clearly linked to known morphology development from literature, with crystalline ice developing compressive and amorphous ice developing tensile stresses respectively, and that amorphous ice films develop additional tensile stresses upon annealing.