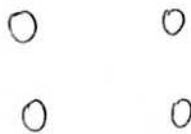


Answers To HW Assignment #2

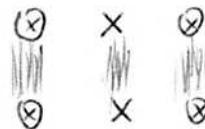
1 (a) Random adsorption does not lead to diffraction, but produces a diffuse smear, which partially interferes with the substrate pattern. When an ordered monolayer is finally formed, one sees additional spots due to adsorbate diffraction. With $\theta = 1/4$, the spots, on average, have $1/2$ the spacing of the substrate reflexes.

(b) When an overlayer is ordered only in one direction, a diffraction pattern will appear in that direction only for the adsorbate. The substrate pattern in the orthogonal direction will be smeared out.

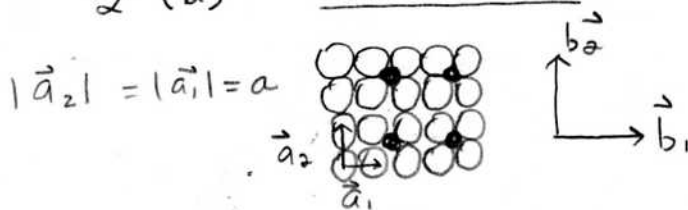
Substrate



Substrate + Adsorbate



2 (b) Real Lattice



$$\vec{b}_1 = 2\vec{a}_1 \quad (\text{c.n.} = 4)$$

$$\vec{b}_2 = 2\vec{a}_2 \quad \theta = \frac{a_1 \times a_2}{b_1 \times b_2} = \frac{1}{4}$$

$$G = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix} \Rightarrow G^* = \frac{1}{|G|} \begin{pmatrix} G_{22} & -G_{21} \\ -G_{12} & G_{11} \end{pmatrix} = \frac{1}{4} \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$$

$$G^* = \begin{pmatrix} 1/2 & 0 \\ 0 & 1/2 \end{pmatrix}$$

$$|\vec{b}_1^*| = 1/2 |\vec{a}_1^*| = 1/2 a^*$$

$$|\vec{b}_2^*| = 1/2 |\vec{a}_2^*| = 1/2 a^*$$

Inverse Net

