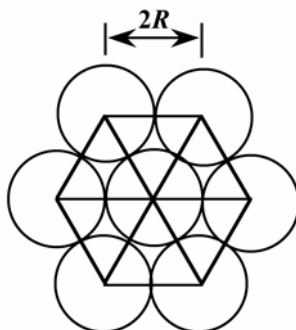


3.55 (a) A (0001) plane for an HCP unit cell is shown below.



Each of the 6 perimeter atoms in this plane is shared with three other unit cells, whereas the center atom is shared with no other unit cells; this gives rise to three equivalent atoms belonging to this plane.

In terms of the atomic radius  $R$ , the area of each of the 6 equilateral triangles that have been drawn is  $R^2\sqrt{3}$ , or the total area of the plane shown is  $6R^2\sqrt{3}$ . And the planar density for this (0001) plane is equal to

$$\begin{aligned} \text{PD}_{0001} &= \frac{\text{number of atoms centered on (0001) plane}}{\text{area of (0001) plane}} \\ &= \frac{3 \text{ atoms}}{6R^2\sqrt{3}} = \frac{1}{2R^2\sqrt{3}} \end{aligned}$$

(b) From the table inside the front cover, the atomic radius for titanium is 0.145 nm. Therefore, the planar density for the (0001) plane is

$$\text{PD}_{0001}(\text{Ti}) = \frac{1}{2R^2\sqrt{3}} = \frac{1}{2\sqrt{3}(0.145 \text{ nm})^2} = 13.73 \text{ nm}^{-2} = 1.373 \times 10^{19} \text{ m}^{-2}$$