ANSWERS TO NUMERICAL QUESTIONS (2003-2004)

1(c) Plane spacing $d_{hkl} = a_0 / \sqrt{(h^2 + k^2 + l^2)}$

For (220) $d_{220} = 0.5646/\sqrt{(4 + 4 + 0)}$nm
$= 0.1996$nm

For (310) $d_{310} = 0.5646/\sqrt{(9 + 1 + 0)}$
$= 0.1785$nm

For (311) $d_{311} = 0.5646/\sqrt{(9 + 1 + 1)}$
$= 0.1702$nm

For (422) $d_{422} = 0.5646/\sqrt{(16 + 4 + 4)}$
$= 0.1152$nm

(d) Angle between planes $(h_1k_1l_1)$ and $(h_2k_2l_2)$ is given by
$\cos^{-1}[(h_1h_2 + k_1k_2 + l_1l_2)/\sqrt{((h_1^2 + k_1^2 + l_1^2)(h_2^2 + k_2^2 + l_2^2))}]$

$(001) \wedge (111) = \cos^{-1}[1/\sqrt{3}] = 54.7^o$
$(011) \wedge (311) = \cos^{-1}[2/\sqrt{22}] = 64.8^o$

(e) $[121]\cdot[1\bar{1}1] = 0$ then (121) is perpendicular to $(1\bar{1}1)$

$[\bar{1}10]\cdot[1\bar{1}3] = 1$ then $(\bar{1}10)$ is not perpendicular to $(1\bar{1}3)$

$[\bar{1}00]\cdot[0\bar{1}3] = 0$ then $(\bar{1}00)$ is perpendicular to $(0\bar{1}3)$

4(b) Diffusion coefficient $(D) = D_0 \exp -[E_A/kT]$

At 1120°C (1393K) $D = 0.76 \times \exp -[3.46/(8.62 \times 10^{-5} \times 1373)]$ cm^2/s

$= 1.53 \times 10^{-13}$ cm^2/s

For 60s $2\sqrt{(Dt)} = 2\sqrt{(1.53 \times 10^{-13} \times 60)}$ cm

$= 6.06 \times 10^{-6}$ cm

$= 0.06\mu$m

Then, autodoping is not a problem.