InGaAs / InAlAs

Yerino 2017 gives $170\,nm/h = \frac{170}{60 \cdot 60}\,nm\,s^{-1} = 0.04722\,nm\,s^{-1}$

desired growth rate. Lattice constant for

InP is $a = .58687\,nm$. Therefore, in the

[111] direction,

$$1\,ML = \frac{a}{\sqrt{3}} = .33883\,nm$$

$\Rightarrow$ desired growth rate of

$$\left(0.04722\right)\frac{nm}{s} \cdot \left(0.33883\right)\frac{ML}{nm} = 0.16\,ML/s.$$

For a $In_{53}Ga_{47}As$ composition this translates

to desired growth rates as follows:

$$\underline{In\ (111)} \Leftrightarrow (.53)(0.16\,ML/s) = \underline{0.0848\,ML/s}$$

$$\underline{Ga\ (111)} \Leftrightarrow (.47)(0.16\,ML/s) = \underline{0.0752\,m/s}$$

OR,

$$\underline{In\ (100)} \Leftrightarrow \frac{2}{\sqrt{3}} \cdot (0.0848\,ML/s) = \underline{0.09792}\,ML/s$$

$$\underline{Ga\ (100)} \Leftrightarrow \frac{2}{\sqrt{3}}(0.0848\,ML/s) = \underline{0.08683}\,ML/s$$

WE USED THE FOLLOWING PIO'S FROM OCT TO OBTAIN THE TEMPERATURE NECESSARY TO ACHIEVE THE ABOVE RATES:

$$In(100) \Leftrightarrow \{ y = -2.5763x + 21.552 \}$$

$$Ga(100) \Leftrightarrow \{ y = -2.7641x + 21.094 \}$$

$$Al(100) \Leftrightarrow \{ y = -3.4826x + 23.609 \}$$

WHERE y IS GROWTH RATE + x IS $\frac{1000}{T(K)}$.

TO ACHEIVE GROWTH RATE OF 0.09792 ML/S $In(100)$, WE HAVE

$$In \begin{cases} \ln(0.09792\ ML/s) = -2.5763x + 21.552 \\ \Rightarrow x = 9.2674 \Rightarrow \boxed{T_g = 1079.05K = 805.9 C^\circ} \end{cases}$$

TO ACHIEVE GROWTH RATE OF .08683 ML/S $Ga(100)$ WE HAVE

$$Ga \begin{cases} \ln(0.08683\ ML/s) = -2.7641x + 21.094 \\ \Rightarrow x = 8.5159 \Rightarrow \boxed{T_g = 1174.29K = 901.14 C^\circ} \end{cases}$$

NOW, FOR $In_{.52}Al_{.48}As$, KEEPING THE SAME TEMPERATURE FOR In MEANS WE HAVE A GROWTH RATE OF .0844 ML/s FOR INDIUM ON THE (111). AGAIN SHOOTING FOR A TOTAL InAlAs RATE OF 0.16 ML/s GIVES THE DESIRED RATE FOR THE Al AS FOLLOWS;

$$0.16\,ML/s - \cancel{0.844\,ML}^{.0848}/s = 0.0752\,ML/s.$$

THIS GIVES OUR Al TEMERATURE AS

Al
$$\begin{cases} \ln\left|\frac{2}{\sqrt{3}}\cdot(0.0752\,ML/s)\right| = -3.4826x + 23.609 \\ \Rightarrow x = 7.4783 \Rightarrow \boxed{T_g = 1337.2K = 1064.03C^\circ} \end{cases}$$