3.22 Mechanical Properties of Materials
Spring 2008

For information about citing these materials or our Terms of Use, visit: http://ocw.mit.edu/terms.
Group: Effects of multidimensional defects on III-V semiconductor mechanics
PS2 part b work detailing calculations of Young’s modulus

We use the following equation to solve for Young’s modulus in the different directions:

\[
\frac{1}{E_{[hkl]}} = S_{11} - 2[(S_{11} - S_{12}) - \frac{1}{2}S_{44}][\alpha^2\beta^2 + \alpha^2\gamma^2 + \beta^2\gamma^2]
\]

From the review article we see that

\[
E_{<100>} = \frac{1}{S_{11}} = 8.547\times10^{10}\text{Pa}
\]

and using \(\alpha = \beta = \gamma = \frac{1}{\sqrt{3}}\)

\[
E_{<111>} = 1.422\times10^{11}\text{Pa}
\]

for \(\alpha = \beta = \frac{1}{\sqrt{2}}\) in the \(<110>\) direction

\[
E_{<110>} = 1.22\times10^{11}\text{Pa}
\]

We conclude that the \(<111>\) direction is the direction with the highest Young’s modulus, hence it will be more resistant to stretching in the direction.