Homework #6 Solutions

Problem 24

We notice that the fringe pattern using λ = 600 nm shifts by an integral number of half wavelengths. The white light pattern reveals that this shift is 2 fringes. We can therefore deduce that the height of the Al line is:

$$h = 2\frac{\lambda}{2} = 600nm.$$

Problem 25

For interference to occur, the difference in the optical path length $|L_2 - L_1|$ must be less than the coherence length of the source L_c.

$$Lc = \frac{\lambda_{av}^2}{\Delta\lambda} = \frac{\left(\frac{600nm + 400nm}{2}\right)^2}{600nm - 400nm} = 1.25\mu m.$$

Problem 26

a) In this class we define resolution as the minimum resolvable spatial period. While NFOM is capable of detecting single molecules, it cannot distinguish between two closely spaced molecules. The line resolution of the NFOM is approximately the diameter of the aperture ($\approx 20nm$).

b) Although there have been slight improvements in resolution since 1994 with improved fabrication, NSOM still cannot completely resolve molecules of this size (and probably never will).