Biomaterials HW 7

Nikhil Menon

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1. From the given parameters, we can calculate the total volume of the cell to be $9.33 * 10^{-23} cm^3$. Then, since there are 4 CH_2 groups, the total mass is

$$\frac{4 * 14(g/mol)}{6.022 * 10^{23} atoms/mol} = 9.29 * 10^{-23} g$$

Therefore, the density of crystalline polyethylene is $0.996 g/cm^3$ If the fraction of the material that is crystal is f,

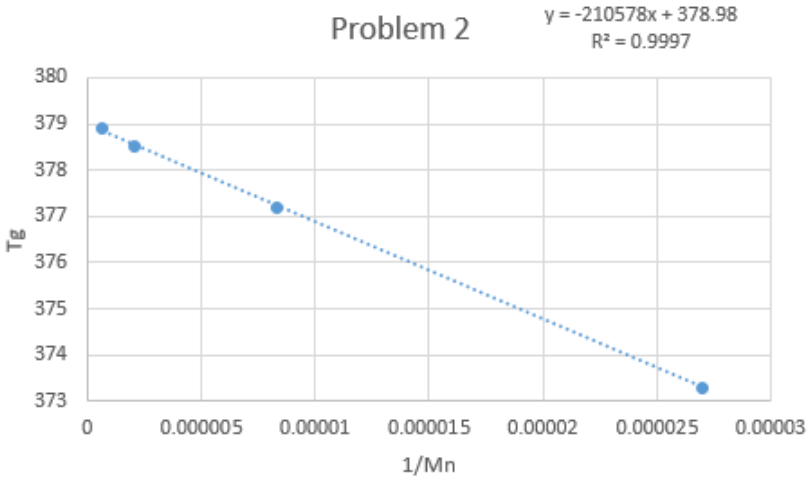
$$0.996f + 0.866(1 - f) = 0.983 g/cm^3, f = 0.89$$

2a. We know that

$$T_g = T_\infty - \frac{K}{M}$$

After performing a linear fit with the given T_G against the inverse of the molecular weight using data,

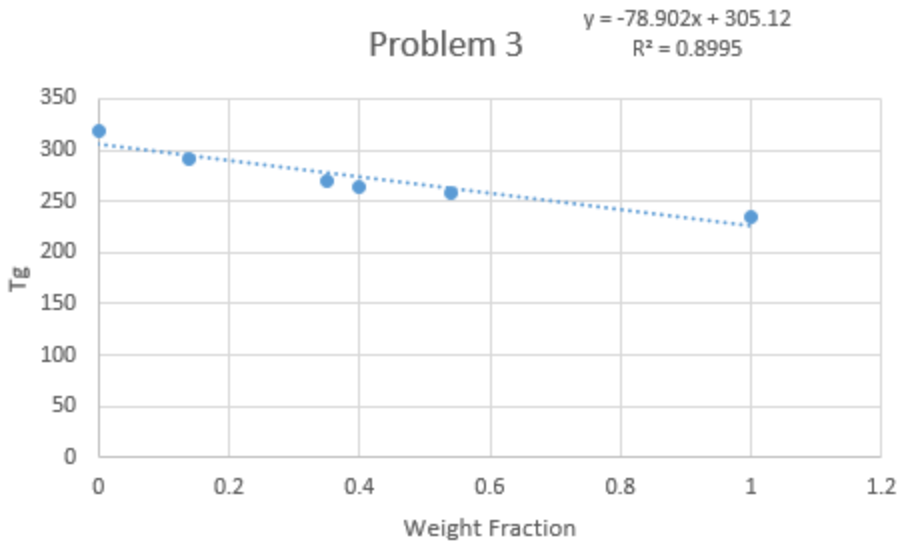
$$T_\infty = 379K, K = 2.1 * 10^5 K g mol^-1$$



2b. For a polydisperse polymer,

$$T_g = w_1 T_{g,1} + w_2 T_{g,2} + w_3 T_{g,3} + w_4 T_{g,4} = 377K$$

3. The T_g should be about 246 K. The plotted data with the equation of best fit is shown below. The data is approximately quadratic, and this modal is a good fit as seen in the high R^2 value.


Problem 3
y = -78.902x + 305.12
R² = 0.8995
350
300
250
200
150
100
50
0
Tg
0
0.2
0.4
0.6
0.8
1
1.2
Weight Fraction