CHE323/384 Chemical Processes for Micro- and Nanofabrication
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Homework #12

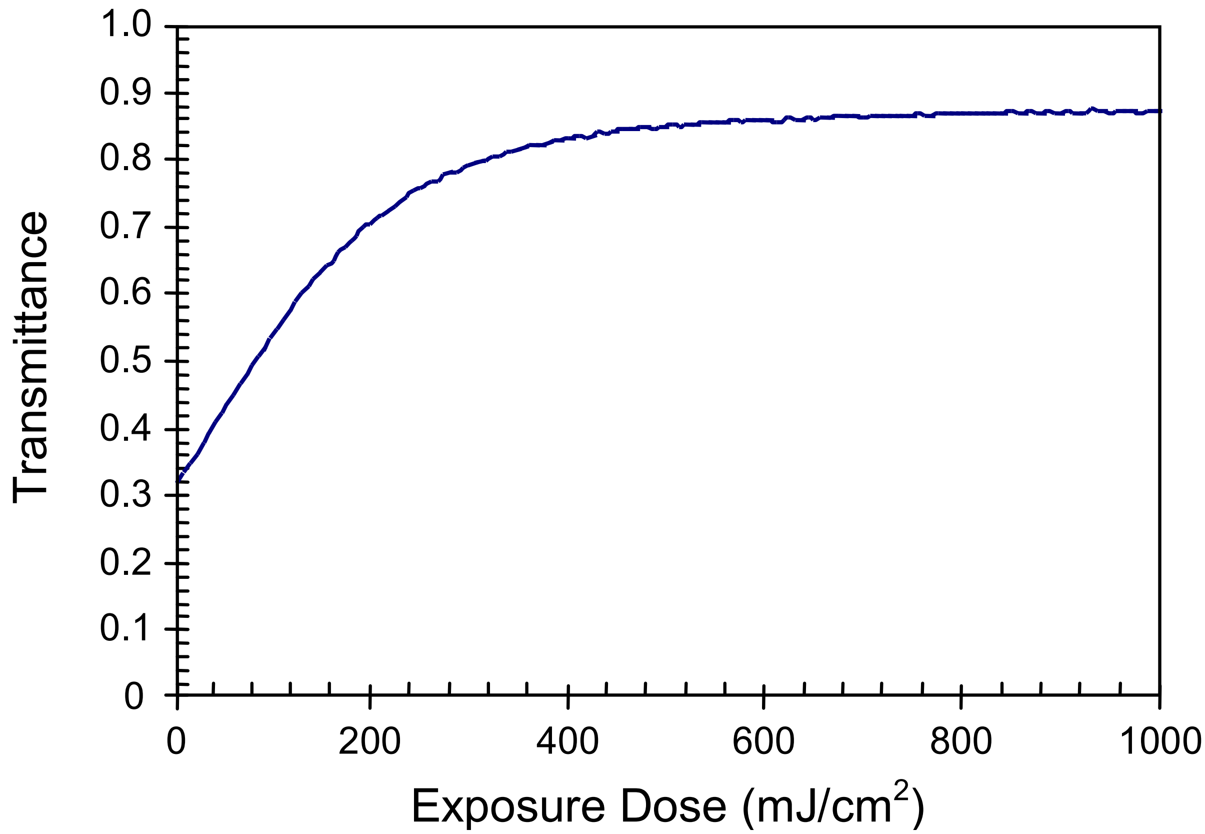
1. An i-line resist has the following properties:

$A = 0.85\ \mu m^{-1}$
$B = 0.05\ \mu m^{-1}$
$C = 0.018\ cm^2/mJ$
Refractive index = 1.72

The resist is coated to a thickness of 1.1 μm on a glass substrate optically matched to the photoresist. At the beginning of exposure, what percentage of the incident light makes it to the bottom of the resist?

Note that $T_{12} = 1 - \left(\frac{n_2 - n_1}{n_2 + n_1}\right)^2$

2. From the transmittance curve below, estimate the values of A, B and C. The resist thickness used was 0.75 μm and the measurement was performed in the standard way. Assume a typical i-line resist with refractive index = 1.69.



3. For a chemically amplified resist (and ignoring the effects of diffusion and acid loss on concentration),

$$h = 1 - e^{-CIt}$$
$$m = e^{-K_{amp} t_{PEB} h}$$

From these equations,

(a) Derive an expression for the relative bake time sensitivity of m (i.e., calculate $dm/d\ln t_{PEB}$).

(b) Derive an expression for the relative temperature sensitivity of m (i.e., calculate $dm/d\ln T$). From this, will a low activation energy resist or a high activation energy resist be more sensitive to temperature variations?

(c) Does the presence of base quencher change the bake time or temperature sensitivity of m?

4. Why does the addition of base quencher reduce the sensitivity of the resist to airborne base contaminants?