

Massachusetts Institute of Technology  
3.155J / 6.152J Micro/Nano Processing Technology  
Fall Term 2005

**Problem Set 6: Lithography, etc.**

**Out: November 4, 2005**

**Due: November 9, 2005**

- 1) Calculate and plot versus exposure wavelength the theoretical resolution and depth of focus for a projection exposure system with an NA of 0.6 (about the best that can be done today). Assume  $k_1 = 0.6$  and  $k_2 = 0.5$ . Consider wavelengths between 100nm and 1000nm. Indicate the common exposure wavelengths being used or considered (i-line, g-line, KrF, ArF). Will an ArF source be adequate for 0.13 and 0.1 micron IC technologies according to these calculations?
  
- 2) Calculate the CMTF for AZ-1450 ( a resist with specs listed below) at four wavelengths. Assuming  $NA = 0.4$ , use the figure below to determine the minimum linewidth for an aligner with  $S = 0.5$  using this resist at various wavelengths. The figure below plots MTF of the aligner for a set of lines and spaces. The lines and spaces are of equal width ( $W$ ), and the spatial frequency is normalized by the Rayleigh criteria,  $R$ . In other words, a normalized spatial frequency of 0.5, corresponds to a linewidth  $W$  equal to  $R$  (since the equivalent source spacing of the lines is  $2W$ ).

Wavelength (nm)	Contrast of AZ-1450
248	0.7
313	3.4
365	3.6
436	3.6

