Tutorial 3 E3013 – Etching I

1. Figure 1 shows the isoetch curve for silicon using the HF:HNO_3:diluent system. If HF: HNO_3: H_2O = 50:30:20, determine the etch rate of silicon.

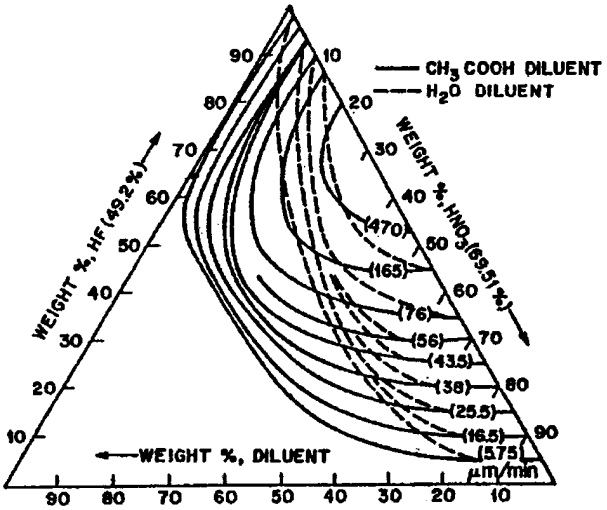

Figure 1 : Isoetch Curves for Silicon

(a) If the diluent is changed to $HC_2H_3O_2$, what will be the new etching rate? Explain why the etch rate is usually higher when the diluent is changed to acetic acid.
(b) Assuming an etch rate of 56 um/min and the ratio of HNO_3: $HC_2H_3O_2$ is maintained at 3:1, what is the %wt of HF used in the etchant.
(c) Define etch selectivity. Explain whether physical etching has high etch selectivity. What are the problems associated with physical etching?
(d) Suggest ways to increase the etch rate of an RIE system.

2. Figure 2 shows the isoetch curve for the etching of Si wafers.

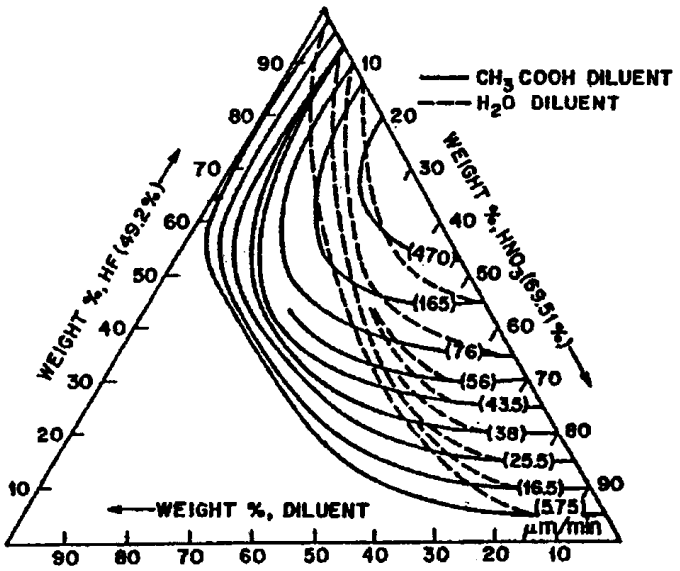

Figure 2 : Isoetch Curves for Silicon

(a) Draw the 7:3 HNO_3-CH3COOH load line on the isoetch curve.
(b) If the etching rate of the silicon is 56 μm/min, derive the respective percentage of the etchant constituents.

3. Figure 3 shows thin film A (thickness ta) with a patterned photo-resist of feature L >> ta on substrate S. Explain why condition L >> t_a is imposed. Complete the table below under the etching condition listed in the table for two etching recipes: (i) no over-etch and (ii) 50% over-etch. The etch selectivity is of A:S is 10:1. State two assumptions about the photoresist.

Profile	**Substrate etch depth , t_s**	**Undercut in A, U_a**
Degree of Anisotropy = 0.70	**(i)**	**(i)**
	(ii)	**(ii)**

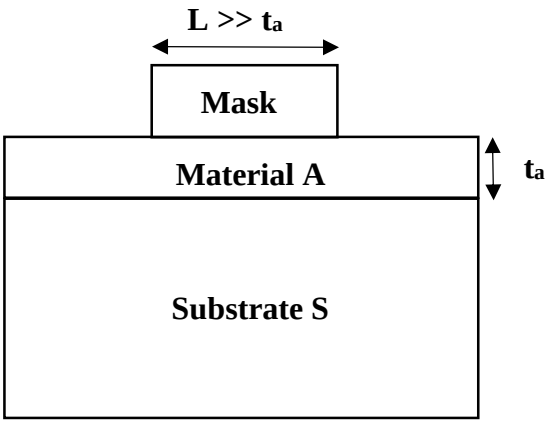

Figure 3