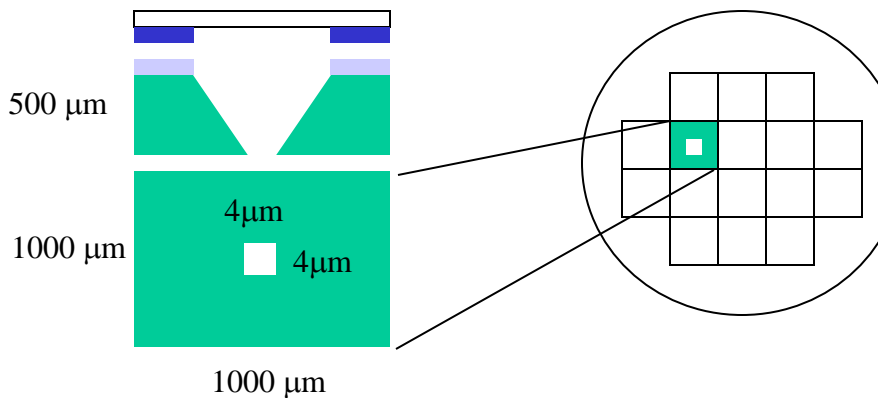


1. In order to open a $4\mu\text{m}$ by $4\mu\text{m}$ hole on a $500\mu\text{m}$ thick (100) wafer anisotropically,

- (a) what's the dimension of the pattern on the resistant mask?
- (b) if the hole is on a $1000\mu\text{m}$ by $1000\mu\text{m}$ chip, how much volume (in percentage) is removed from this chip?

When using SiO_2 as the resistant mask, how thick will the SiO_2 film be to protect the silicon wafer, if the etchant is

- (c) KOH (etch rate: $1.5\mu\text{m}/\text{min}$ for (100) Si, $1.5\text{ nm}/\text{min}$ for SiO_2)
- (d) EDP (etch rate: $0.75\mu\text{m}/\text{min}$ for (100) Si, $0.2\text{ nm}/\text{min}$ for SiO_2)



2. As shown in the figure, the sacrificial layer is removed by undercutting through the access hole. The top structural layer is uniform and $2\mu\text{m}$ thick. The length of the sacrificial layer is $100\mu\text{m}$. During the release, the structural layers are exposed to the sacrificial etch. Assume that the sacrificial layer etch proceeds at a uniform rate $R=1\mu\text{m}/\text{min}$, and the etch has a selectivity of $600:1$.

- (a) Calculate the time required to remove the sacrificial layer.
- (b) Calculate the profile of the walls inside the channel.
- (c) What is the final shape of the channel.
- (d) What is the minimum and maximum thickness.

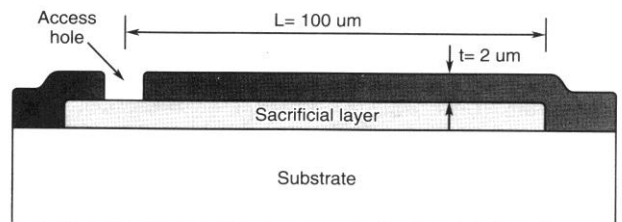


Fig. P2

3. In problem 2,

- (a) Calculate the minimum selectivity required such that the structural layer is not removed.
- (b) Calculate the selectivity such that the wall thickness does not change by more than 15%.