LAB REPORT 1
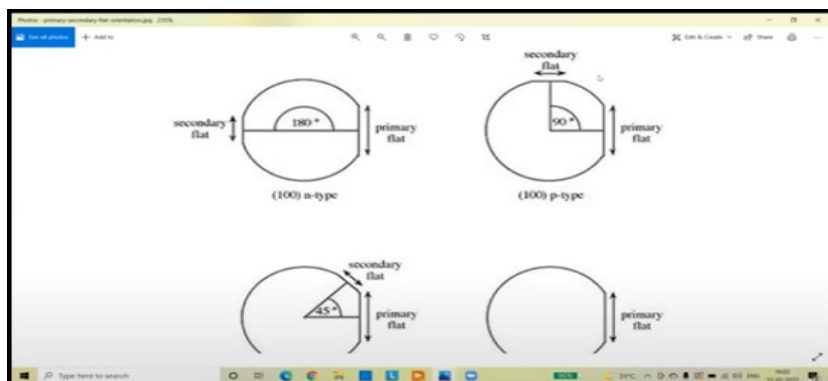## Cleaving, dicing wafers & cleaning

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> Si wafers can be identified   with respective the primary flat and secondary flat.

   Primary flat is bigger in size compare to secondary flat.

➢ We have four type of sub depending on the angle between Primary flat and secondary flat

1. Angle between Primary flat and secondary flat is 180 n-type (1,0,0) plane
2. Angle between Primary flat and secondary flat is 90 p-type (1,0,0) plane
3. Angle between Primary flat and secondary flat is 45 n-type (1,1,1) plane
4. Only Primary flat   present p type (1,1,1) plane

Let us take Si wafer of 2 inch in diameter and 500 microns. P type Si sub and orientation is (1, 0, 0) single side polished substrate.
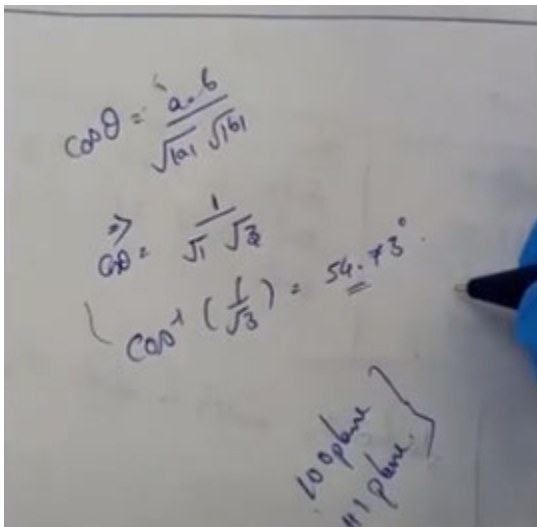
Cleaving: dicing

➢ Use safety gluse to avoid finger prints on the surface which will contaminate.

➢ Let us take cleaning station (lattice gear) cleaning station Useful tools for cleaning :

1. Mat : mat contains scale (1 cm grids), place our p sub (1,0,0) Si wafer on one of the horizontal line on mat.

2. We have scribing tools which are used for scribing the si wafer. This scribing tool contain the diamond tip. We choose one of scribing tool based on our requirement. use roller and scribe vertically on Si wafer which is placed on the mat. Then we can able to see one line on the wafer it divides wafer into two half.

3. Use plier and co inside the line with scribed line and apply little pleasure. It will cut wafer into two half.
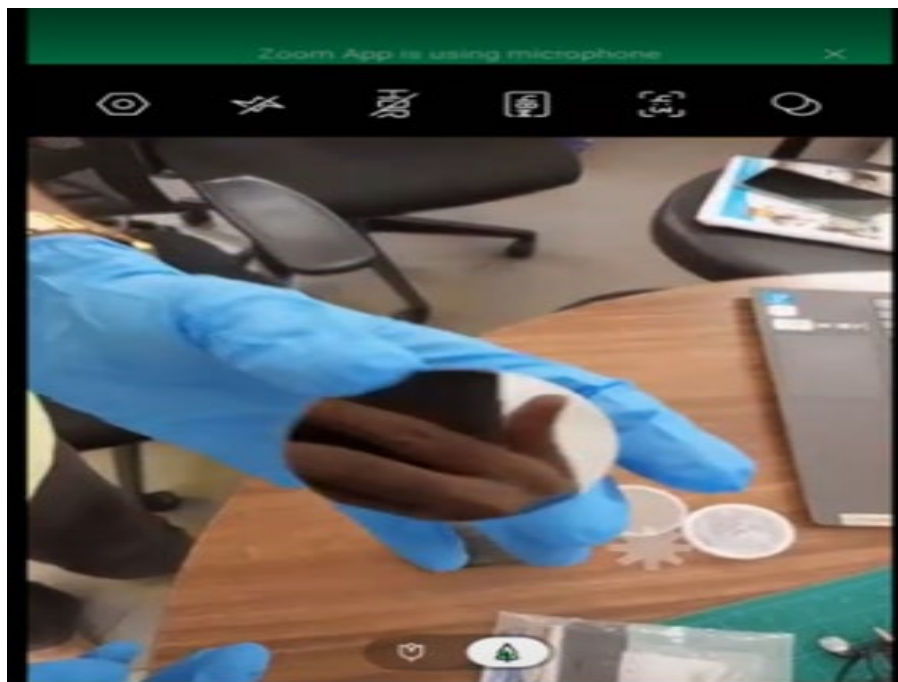
Precautions :

➤ Wafer is very thin and brittle so it should not fall down.

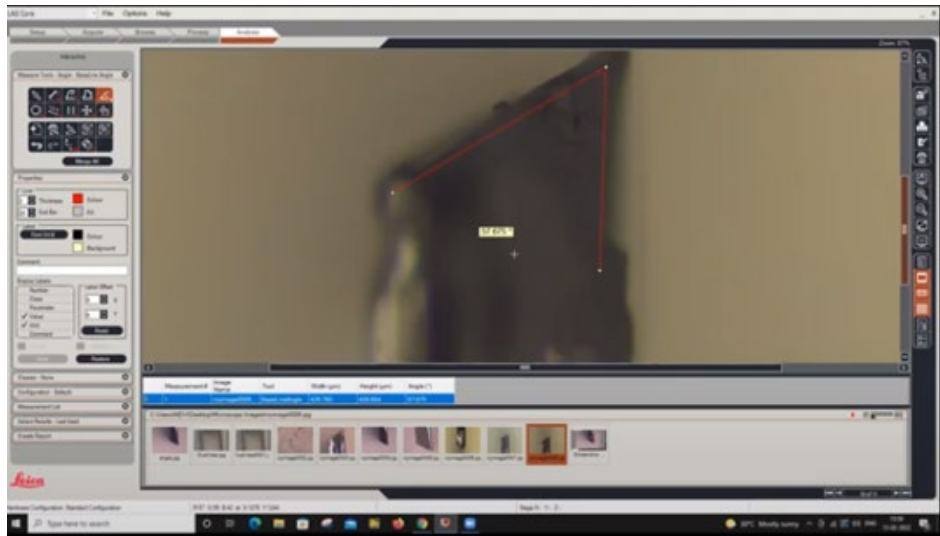➤ Wafer which we took is (100) plane but it cut alone (111) plane . So we use

$$\cos\theta = \frac{a\cdot b}{\sqrt{101}\,\sqrt{161}}$$

$$\Rightarrow \cos\theta = \frac{1}{\sqrt{1}\,\sqrt{3}}$$

$$\cos^{-1}\left(\frac{1}{\sqrt{3}}\right) = 54.73°$$

100 plane
111 plane

We check the angle with the help of optical microscope.
➤ Accure the cross sectional image of Si wafer from microscope to computer. For accruing the image we have to adjust the X Y axis in the microscope.

➢ From the image we can observe the inclination. Select the angle tool, draw the parallel lines. We got 57.67^o with help of microscope.

RCA cleaning

DI Water plant: it will displace the DI water to 28.5 M ohms. DI water is free from ions and has high resistivity.


RCA cleaning divided into two parts RCA1 and RCA2

RCA1

1. Mix NH_4OH (20 ml) with DI water(100ml) 1:5, this mixture we have to place on the hot plate, in this we have to adjust temperature($75^o c$) and timer (15 minutes).

2. After 15 minutes use thermocouple to measure the temperature by inserting into the solution. It should reach $75^o c$. (note : this inserting the thermocouple should not repeat many time because it may introduce impurities).

3. Above solution we have to mix with H_2O_2 (20 ml)(30%) . ratios of DI water, NH_4OH and H_2O_2 should be 5:1:1. Now take Si sample and transferred to beaker . it should be 15 minutes it should be in solution.

4. After RCA 1 we should clean with DI water.

5. After placing the Si samples in RCA1 it should be heated for 15 minutes.

6. Again we should clean Si samples with DI water.
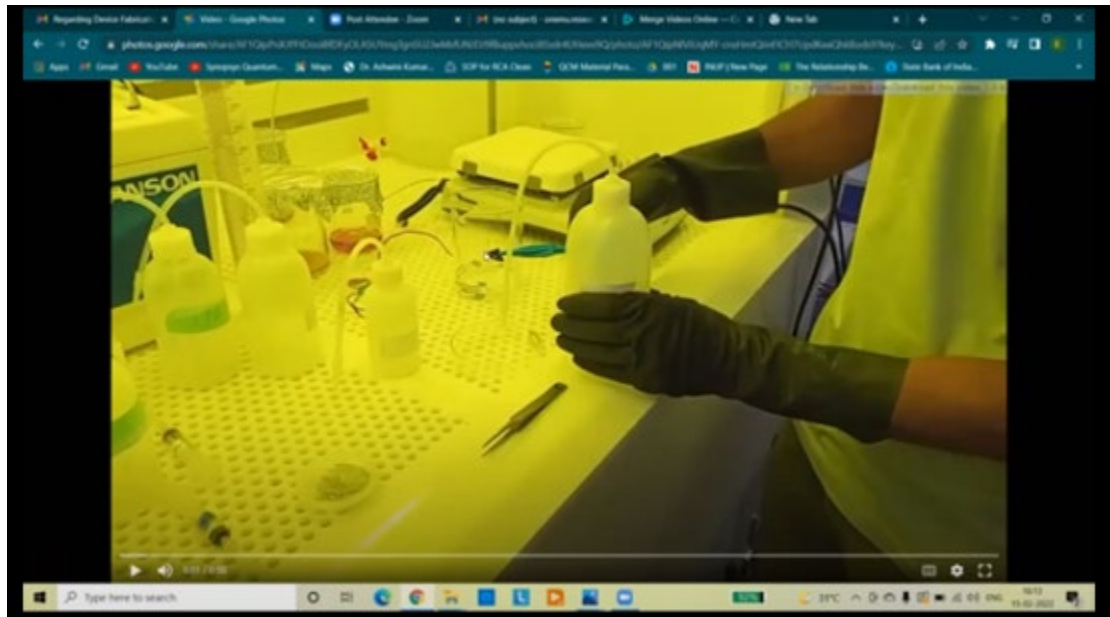
Precaution: we should not use the iron to transfer the Si in RCA 1 solution because it may react with RCA1. We can use plastic.

We have to use acid resistance glues to protect our hands.

RCA2 is similar to RCA1 difference is instead of NH_4OH replaced with HCl

RCA2

DI water, HCl and H_2O_2 in the proportion of 5:1:1 (100 ml DI water, 20 ml of HCl and 20 ml of H2o2).

1. DI water and HCl solution heated up to $75^o c$ for 15 minutes.
2. H_2O_2 Transformed into the beaker. Cleaned Si samples dip into RCA2 solution. This solution is heated up for 15 minutes.
3. Again we should clean Si samples with DI water.
4. HF dip: hydrofluoric acid (DI: HF is 50: 1) for this we have to take 100 ml of DI water and 2ml of HF.
   Note: HF must be precise. If it is increased it may itch the top layer of Si.
   Place Si sample in HF solution it is called as HF dip.
   HF dip must be 2 minutes precisely.
5. Again we should clean Si samples with DI water.
6. Si samples have to dried with Nitrogen.