ASTF - 2024 Questions

1. Crystal Growth

1.1 Motivation for diameter reduction "neck" in early phase of crystal growth process.

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2. layers & doping

2.1 explain the term yield. name three manufacturing process parameter which impact yield.

2.2 What is the purpose of bubbler. why is there the need to use a bubbler, how does it work.

2.3 Explain the term elector migration. explain the mechanism of “electro-migration”. why is it important, to avoid it.

2.4 Explain the principle of a mass separator. Why is it important to use it inside an ion implanter?

- To have homogeneous ions, same depth.
- the magnetic field goes through the paper (go inside) mark it with X to indicate its going in

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3. Etch & Litho

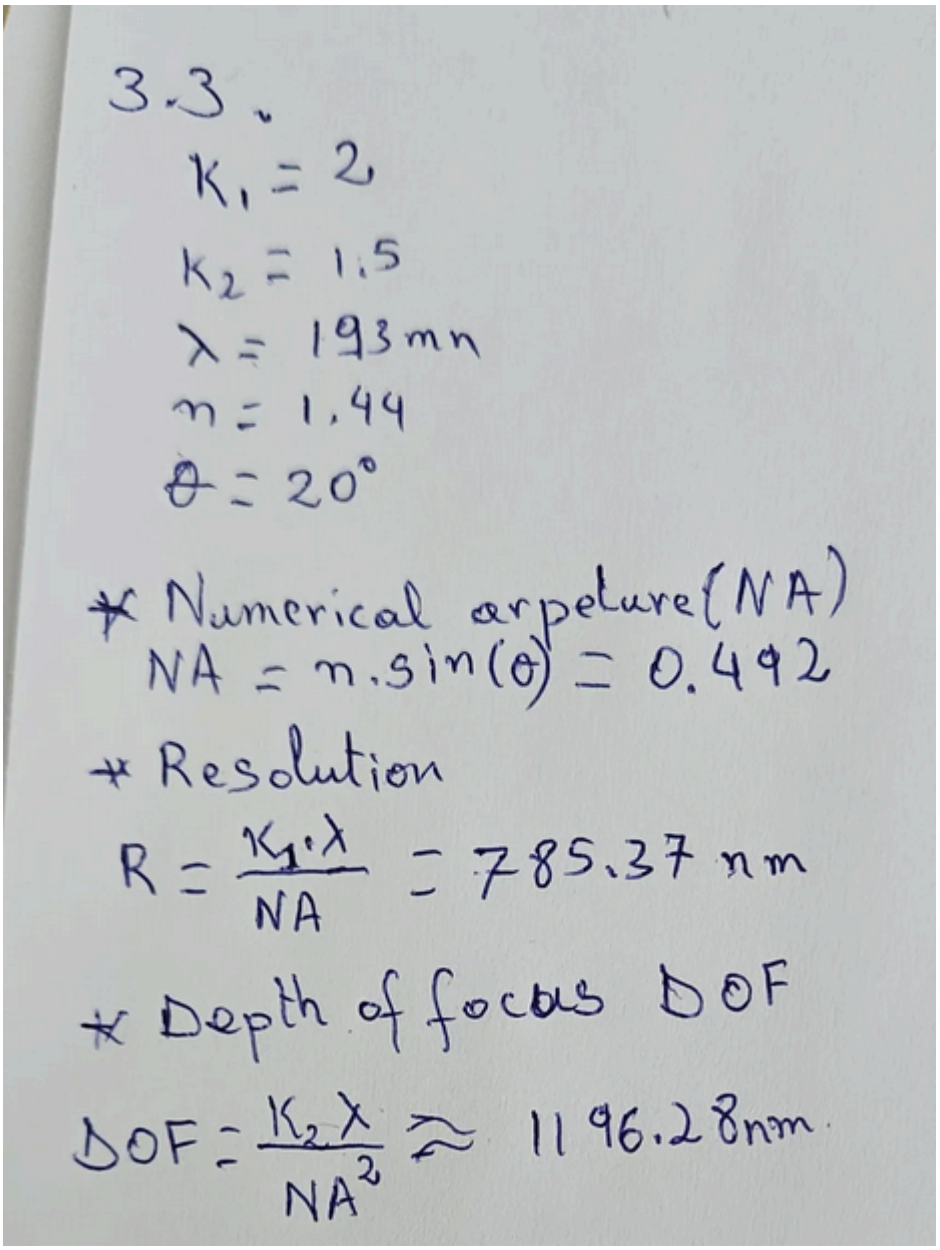
3.1 Why can we obtain a straight etch profile in HDP as compared to RIE.

3.2 What material is the anti-reflective coating? Name two examples

- eg: Organic, Dielectric materials (DARC → Dielectric Anti Reflective Coating)

3.3

3.3. (6 points)
Assume: k1 = 2; k2 = 1.5; λ = 193 nm; n = 1.44; max. acceptance angle = 20° (= arbitrary values)
Calculate: NA; R; depth of focus



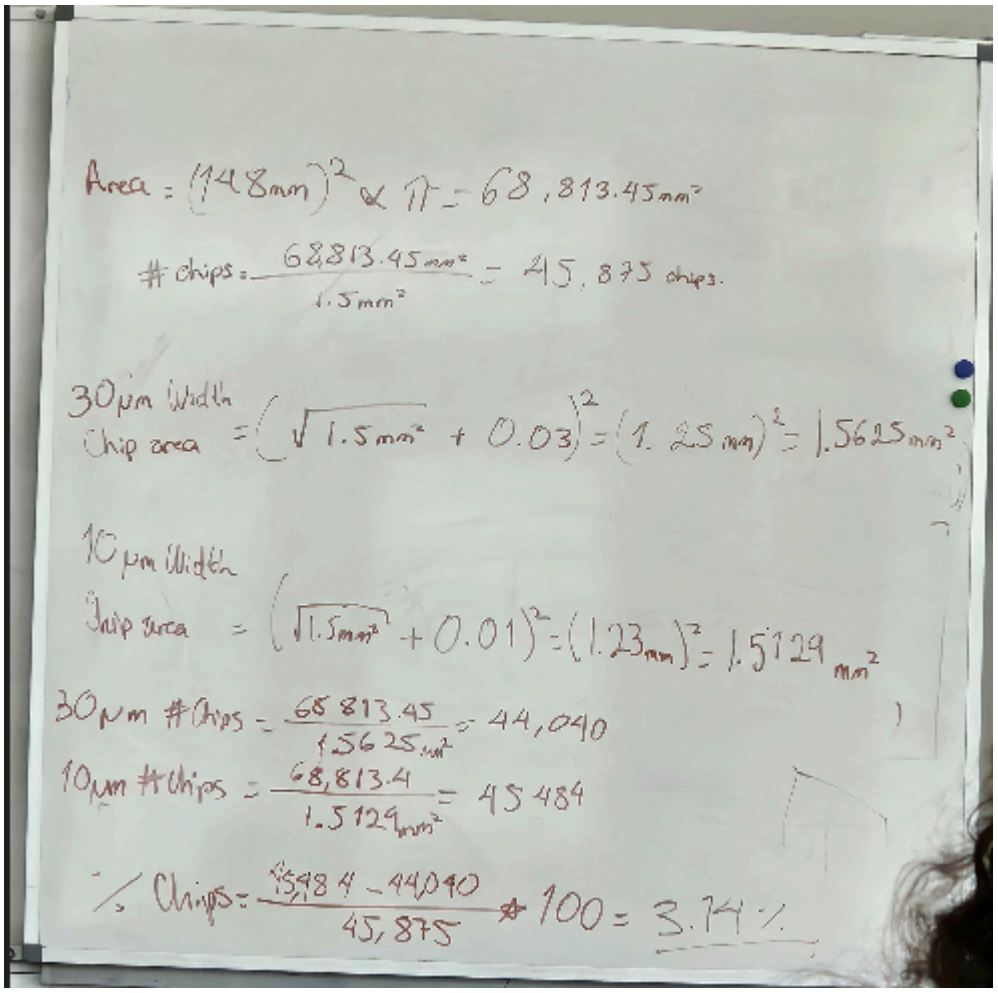
3.4 What is the motivation behind double exposure and explain, how it works.

- why: To print features that are beyond the resolution.

4. Back End & Testing

4.1

4.1. (6 points)
Calculate the increase in the number of chips/wafer in percent, when changing the sawing track from 30 to 10µm? Pls consider 2mm edge exclusion. Assume a chip size of 1,5mm² (squared) and a 12" a wafer.



4.2 Explain the term "reflow soldering"

4.3 Explain the term "underfilling". What is the motivation to do this?

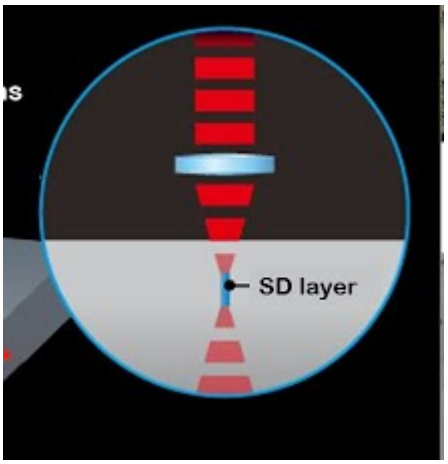
4.4 Explain, why Pico second lasers lead to better results regarding side wall quality during laser full cut as compared to

Nano second laser.

- Pico is short pulse, so it doesnt give time for the heat to transfer to other materials

4.5 In laser stealth dicing an IR laser is used to generate voids and amorphous silicon underneath the surface. explain why void etc. are not found at the surface

- In the surface the focus of the laser is low and underneath the surface its high.



4.6 Explain the term Burn In. How does it work? What is the motivation to do burn in how do you estimate burn in yield and what kind of information do we get from burn in yield.

- Aging process, uses heat to age the sensor.
- work: provide voltage (heat internal), run it for 1000 hours, then test it.
- test: Perform the functional test before and after burn in
- Motivation: Sort out the bad sensors
- Draw bathtub curve

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5. Sensors

5.1 What is the minimum resolution of a 10 bit angle sensor.

5.2 Explain the term saturation of sensors and name at least one example.

- eg: magnetic sensor hysteresis
- No more

5.3 Explain the differences between repeatability and reproducibility. Why is this difference important.

- Repeatability → Same output in same condition, person etc.
- Reproducibility → Same result in different condition, person etc

5.4 Explain the formation of Weis domain.

- ferro magnetic material after applying heat above Tc without external field becomes paramagnetic → when it cool down → neighboring atoms orient themslef in the same direction.

5.5 Explain the magnetic hysteresis for ferromagnetic materials, eg iron. Explain the related physical mechanism.

- Draw the hysteresis graph
- Determines the magnetic behavior of a material when exposed to magnetic field.
- physical: saturation point all the spins are in the same direction. At the beginning its random...
- Explain coercitive MF and remaning magnetism