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Etec Systems

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Multibeams in a Single Column
Etec

PROGRAM:

Advanced Lithography

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Problems to address

- Etec's view on chuck style and capabilities
- Chucking of masks on pattern writing machines.
- Brief assessment on implementing a new, thinner substrate

- Other ISMT issues related to EUV mask not addressed here
  - Define the EUV mask backside films to best enable electrostatic clamping and serve other performance requirements.
  - Mask carrier: how it can protect the mask from contamination and particle risks
  - Mask robotics, gripping, and tool interfaces, and mask cleaning.

ISMT Mask-chuck and handling vision

- Mask-chuck is an integrated unit that is passed from tool to tool as the various process steps occur
  - patterning
  - lithography
  - metrology
- Chuck design must be interchangeable with other chucks used on the above tool suite
  - stiffness
  - pressure
  - flatness
  - other chuck parameters?
    - Pad/pedestal pitch or diameter?

EUV Mask chucks

- Chuck type:
  - 3 point kinematic mount
    - s/w correction capability of systematic position errors does exist “dynamic grid matching” but….
      - every EUV reticle has a unique signature.
    - it appears the only way to correct would be to premap the front and back side
      - doesn’t look practical
  - vacuum or electrostatic
    - for e-beam pattern generators an electrostatic chuck is required
- Technical challenge
  - The biggest challenge would be to provide an electrostatic chuck with the required flatness
    - 3 nm peak-valley over 10 mm square
    - 50 nm peak-valley over 150 mm square
  - The clamping pressure requirement (about 2.2 psig) seems to be feasible with electrostatic clamping.

EUV Mask chucking

- Electrostatic chuck design drives certain backside material requirements
  - May be conductive or nonconductive depending on type of chuck
  - If backside is conductive then it must be grounded
- Other requirements
  - top surface must be grounded
  - desirable to have side of the reticle be conductive to maintain a contiguous ground plane, which minimizes charging artifacts during patterning
- It would be helpful to establish
  - standard chuck requirements and possible design, which will influence backside material choice
  - cross-company collaboration, or standardization of requirements to ensure optimal design approach that all can use
    - pattern generator group
    - EUV litho tool
    - metrology group
    - Other affected groups: inspection?process?

Chuck and substrate thickness

- Plugging Zerodur(TM) properties into the chuck stiffness formula

$$D = \frac{E\,h^3}{12\left(1 - \nu^2\right)}$$

  - results in a minimum Zerodur chuck thickness of 15.55 mm.
  - Our standard chuck-pallet format allows for a thickness of 17.8 mm, so it is physically possible to fit an EUV type chuck in our present Stage Mirror.

- Present Chuck-pallet design format
  - handles 6.35 mm thick reticles
  - a thinner ~ 4.0 mm substrate is consistent with the present form factor
  - cost and performance impacts on patterning are not presently known and will be dependent on the details of the chuck design, nature of the EUV-reticle-substrate, and pattern generator print strategy

Summary observations

- There is a fundamental decision to be made whether commercial equipment must depend on the adequacy of the chuck design, which ensures substrate flatness, to achieve the requisite pattern placement accuracy
- Not clear that equipment vendors need or require a wafer chuck design standard to meet EUV substrate accuracy requirements

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