157nm Lithography

Semiconductor Lithography Workshop
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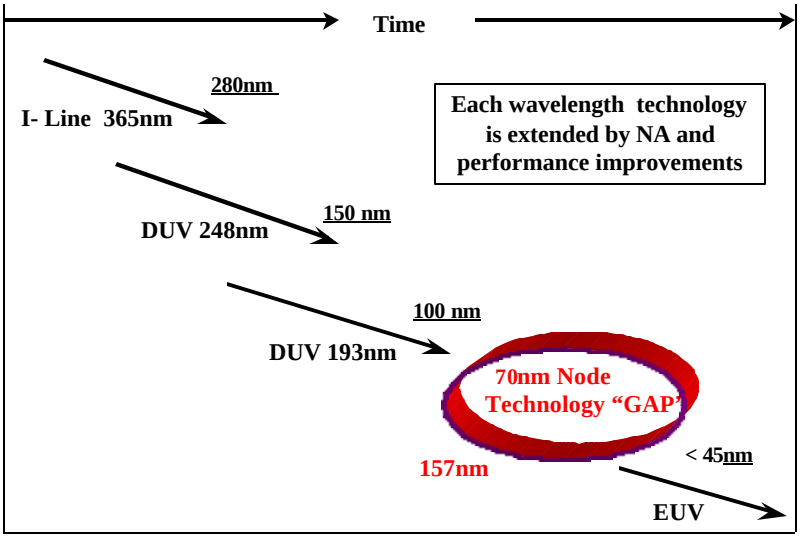
Why is 157nm Attractive Now?

- **A year and half ago it was not included in any discussions.**
- **Its attractive now because of advancements made in:**
  - **Light source, pulsed F2 Laser.**
  - **Optical material with transmission @ 157nm (CaF2)**
- **Laser development is moving rapidly.**
- **SVGL quietly worked the CaF2 material issue.**
  - **Demonstrated feasibility of the "cube"**
- **These are key enablers making an exposure tool possible.**

Evolution not Revolution!

Technology "Gap"



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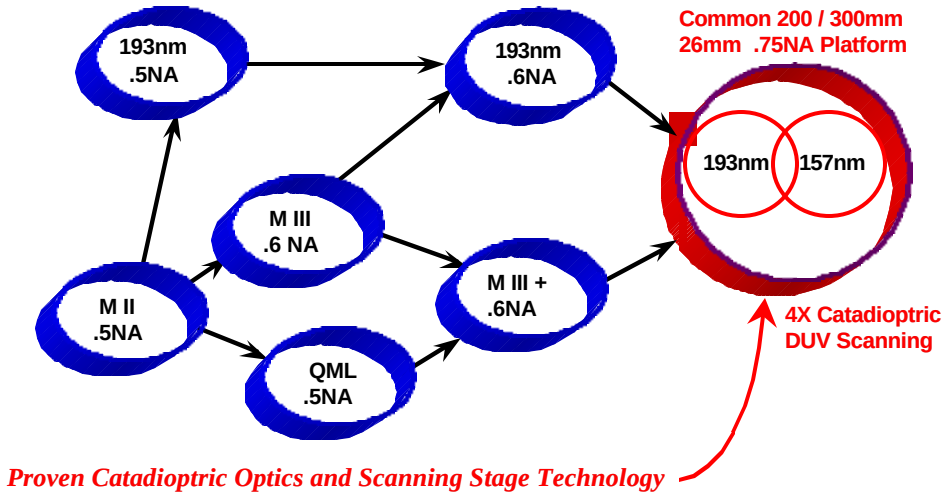
157nm Technology Evolution



Proven Catadioptric Optics and Scanning Stage Technology

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SVGL 157nm Program Approach

- **Identification of risk areas.**
- **Participation in Sematech CRADA.**
- **Collaboration with key partners:**
  - **CaF_2 Material**
  - **Laser Development**
  - **Modeling**
  - **Materials Testing**
  - **Purging & Contamination**
  - **Coating Development**
- **Proof of Concept Demonstration with Mini-Scanner.**
- **Full Field Demonstration.**

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Risk Definition & Mitigation

Key Risk Area	*Issue*	*Mitigation Approach*
1) Contamination	-Affects all aspects of the system, including build.	-Engagement of National Labs with investigations / studies.
2) Purging	-Efficiency of system, purging of optical path incl reticle & wafer space.	-Combination of analysis and breadboard measurements. Evolution of X-ray. Engagement with Ultra High Vac
3) Resist / Processing	-Limited knowledge base.	-Extension of current resist chemistries & develop via Sematech, MIT, others.
4) Reticle & Pellicle Mat'l and fabrication.	-Reticle mat'l promising, pellicle is issue.	-Materials testing via Sematech / MIT CRADA.
5) CaF_2 Optical Mat'l	-B/S cube required for catadioptric design.	-3 suppliers, parallel effort, with key milestones at design reviews.
6) Optical Coatings	-Limited basic materials available.	-In-house and multi-subcontract effort. Phase approach with key milestones.
7) Opt Mat'l and Coating Laser Durability.	-Inconsistent mat'l quality and unknowns of coatings.	-Testing via Sematech / MIT CRADA. Also SVGL progams & CRADA's.
8) Advanced Metrology	-LWC req's improvement in all areas: Optics, align, wafer, reticles, litho.	-All need to be addressed by industry in general. Extensive SVGL effort to develop novel litho tests.
9) Laser Development	-Improved power and increased rep rate with decrease in consummables	-Lambda Physik is primary approach. Started 2nd source with Cymer and engaged in discussions with Komatsu.

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157nm Mini-Scanner

Development of a 157nm Mini-Scanner

- **Now under contract with Tropel for development of a small field 157nm optical train.**
- **Utilizes a modified Micrascan III+ as the body basis.**
- **Variable NA (.4 - .75) and variable sigma (.3 - .8)**
- **Provides SVGL a system for early demonstration of critical concepts (purging, contamination etc..)**
- **Provides customer base a system for early 157nm resist, reticle development.**
- **4mm x 22mm scan field *with overlay capability* provides a vehicle for early process development.**

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Full Field 157nm

Development of a Full Field 157nm Step & Scan

- **4X reduction, Variable NA (.4 to .75), 26mm x 34mm field continuos zoom illumination 26mm - 11mm.**
- **Evolution of SVG catadioptric B/S cube design.**
- **Development of CaF_2 large size " cube" is key ingredient.**
  - **Engaged with multiple material partners**
  - **Results are encouraging.**
- **Still requires development of masks,pellicles and resists.**
  - **Collaborative interaction with Customers, Sematech and Labs.**
- **Utilizes the common VHNA 200mm/300mm platform.**
  - **Modified for the 157nm requirements**
- **Mini-scanner will be used to demonstrate key concepts.**

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