Target of the workshop

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Challenges for future lithography (from the report of IRDS)

https://irds.ieee.org/editions/2022/irds%E2%84%A2-2022-lithography

Table LITH-4 The Key Challenges of High-NA EUV Lithography

Key challenges
Resists meeting resolution requirements, with low levels of defects from stochastic phenomena and pattern collapse
Light sources that can support photon shot noise and productivity requirements
Solutions for meeting small depths-of-focus at 0.55 NA
Polarization control for maintaining high contrast at 0.55 NA
Computational lithography capabilities
Mask making and metrology infrastructure
Solutions for large dies
Cost of high-NA EUV lithography

Table LITH-2 Potential Solutions for Leading-Edge Logic Lithography

	2022	2025	2028	2031	2034	2037
Logic node	3 nm	2.1 nm	1.5 nm	1.0 nm	0.7 nm	0.5 nm
Node	G48M24	G45M20	G42M16	G40M16T2	G38M16T4	G38M16T6
Minimum ½-pitch	12 nm	10	8 nm	8 nm	8 nm	8 nm
Primary options for logic	EUV 0.33.NA multiple patterning	EUV 0.33.NA multiple patterning EUV 0.55.NA single patterning	EUV 0.55.NA single patterning EUV 0.55.NA multiple patterning	EUV 0.55.NA single patterning EUV 0.55.NA multiple patterning Beyond EUVL (λ=6.X nm)	EUV 0.55.NA single patterning EUV 0.55.NA multiple patterning Beyond EUVL (λ=6.X nm)	EUV 0.55.NA single patterning EUV 0.55.NA multiple patterning Beyond EUVL (λ=6.X nm)
Potential solutions for cost reduction, LER reduction		Optical + DSA EUV + DSA	Optical + DSA EUV + DSA	Optical + DSA EUV + DSA	Optical + DSA EUV + DSA	Optical + DSA EUV + DSA

- **Beyond EUV -> wavelength tunability**
- **To avoid stochastics -> Higher-power**
- **Polarization control**
- **Cost reduction for exposure system**

<Key-note lecture>

Harry J. Levinson: Free-electron lasers and the future of EUV lithography

<Invited speakers>

Takeo Watanabe: Technical issue of EUVL and prospect for EUVL and Beyond EUVL

Norio Nakamura: Present state of the EUV-FEL light source for future lithography

Takahiro Kozawa: Current status and prospect of extreme ultraviolet resists

Seiji Nagahara: TEL's Patterning Approaches Toward High NA EUV Lithography

We hope that the solutions and/or issues for the previous challenges for future Lithography can be found and/or understood after the above presentation in this workshop