

Extreme Ultraviolet Lithography (EUV)

ECE – 487

SEMICONDUCTOR FACTORY DESIGN &
OPERATION

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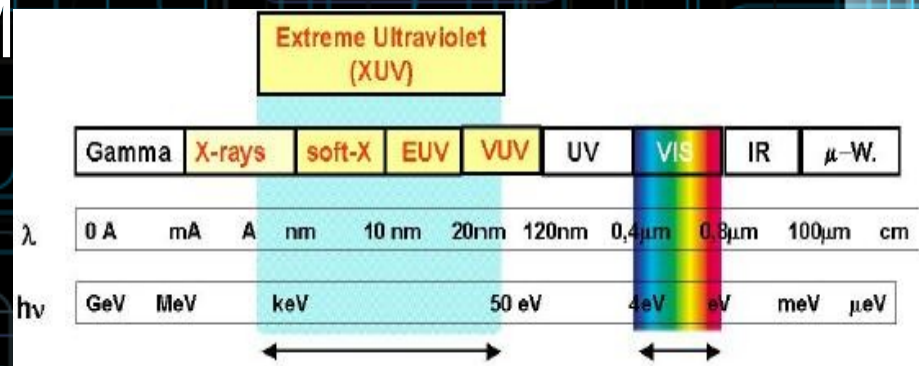


Outline

- What is EUV
- Technology
- Application
- Advantages and Disadvantages
- Summary
- References

What is EUVL

- Extreme Ultraviolet Lithography(EUVL)
- Optical lithography is the major technology used to print circuit patterns onto chips^[4]
- Most commercial microchip is produced using the lithography process ^[4]
- EUVL is an advanced form of lithography which allows for HVM
- $\lambda = 13.5\text{nm}$ (EUVL)^[2]
- Deep UV is current technology^[6]

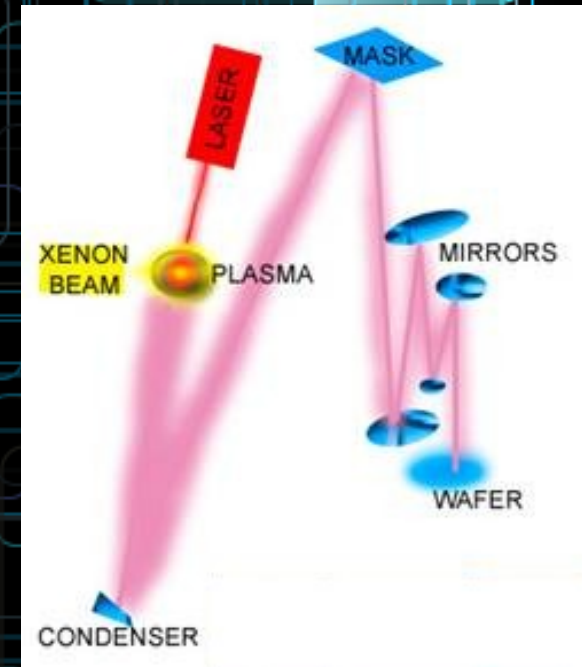


Technology

- Advances in optical lithography enable integration density of microchips
- Increased density allows a greater number of transistors per chip
- The minimum feature size which can be printed on a chip is limited by the resolution of the optical lithography system
- $\text{Res} = \frac{K_1 \lambda}{NA}$ $k =$ process factor, $NA =$ numerical aperture

Technology

- How is it produced
- Reduced feature size leads to increased number of transistors on chip
 - Laser produced light source
 - X-ray laser
 - Uses multiple mirrors to increase $NA \frac{K_1 \lambda}{NA}$, which accomplishes better resolution



Application

- Allow for less than 20 nm transistors,^[2] currently they are 45 or 65 nm ^[3]
- Potential for future chips to obtain 1000 times the memory capacity and 100 times faster than today's chips ^[1]
- Implemented for chips in 2011 ^[3]
- Device speeds increase with smaller gate lengths

Advantages

- Helps produce smaller feature size
 - Speed and number of transistors
 - Reduction in size
 - HVM
 - Competitive advantage
 - Cost

Disadvantages

- Increased cost for new technology
- Requires higher demands on position accuracy and stability of mirror tolerance
- More complexity for EUVL^[4]
- Concern about the reliability of EUVL with respect to other lithography^[5]

Summary

- Extreme Ultraviolet Lithography (EUV)
- Upcoming technology for the latest in Lithography
- Shorter wavelengths used to minimize feature size
- 32 nm technology [4]

References

- 1 <http://www.sematech.org/research/lithography.htm> Extreme Ultraviolet Lithography
- 2 Optik & Photonik June 2008 No. 2 p. 35-38, Winfried Kaiser, Peter Kuerz
- 3 iEEE Spectrum March 2008, A New Light Source for EUV Lithography, p. 14 Saswato R. Das
- 4 Yaxin Yu CHTM PHD Candidate
- 5 EUV Lithography-The Successor to Optical Lithography, Intel Tech. Journal Principles of Lithography, Harry J. Levinson
- 6 Rodger Cook, Guest Lecturer