Nano-patterning of improved imaging properties by using phase-shift mask technology in EUVL

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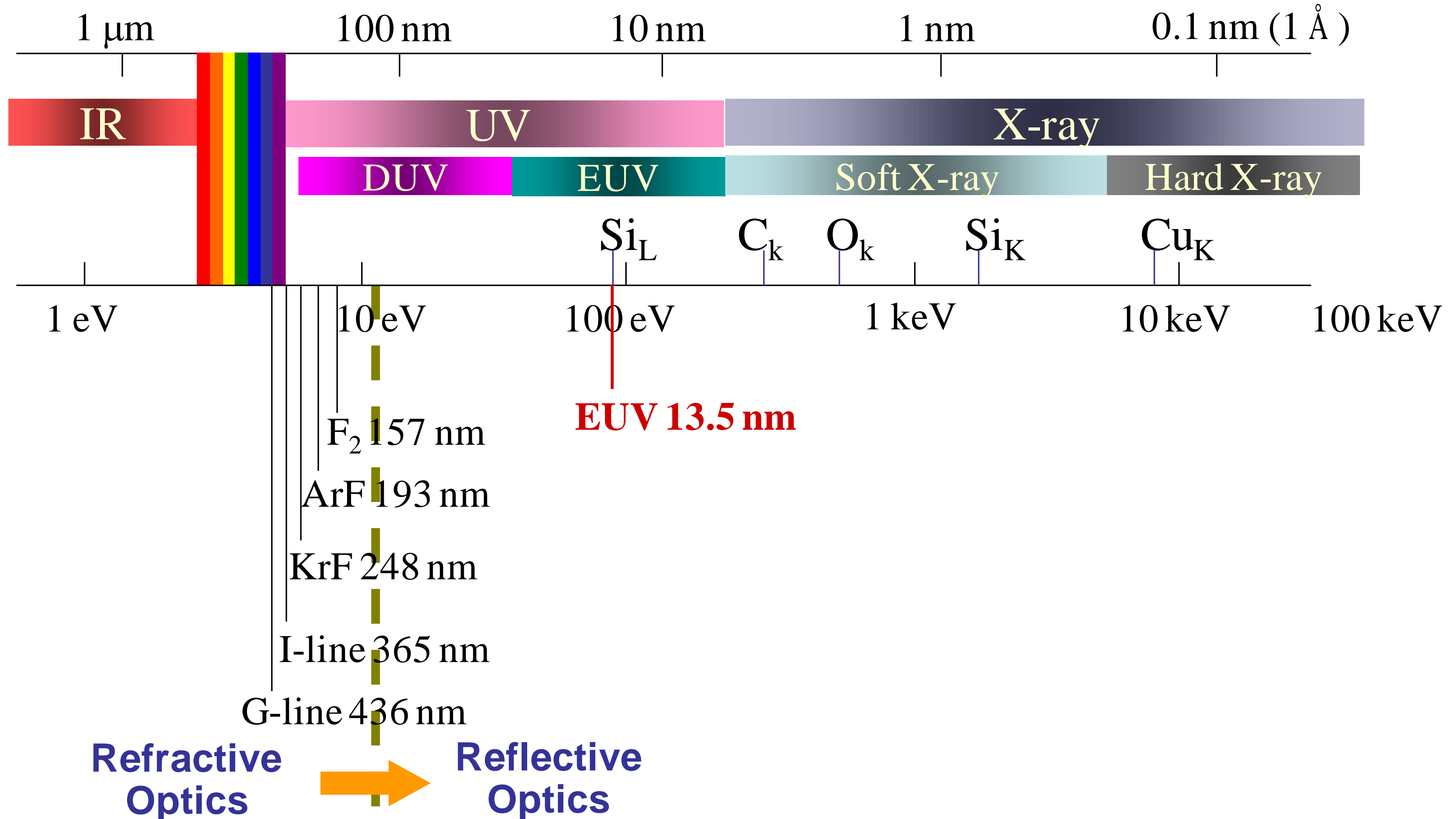
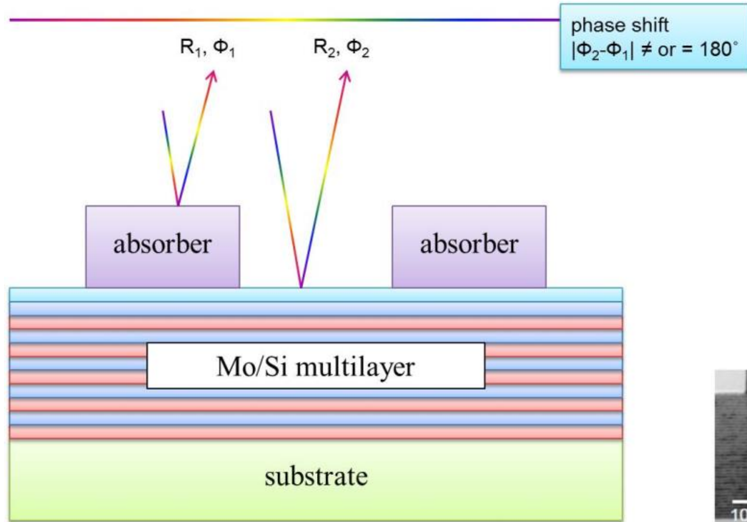
What is Extreme Ultraviolet?

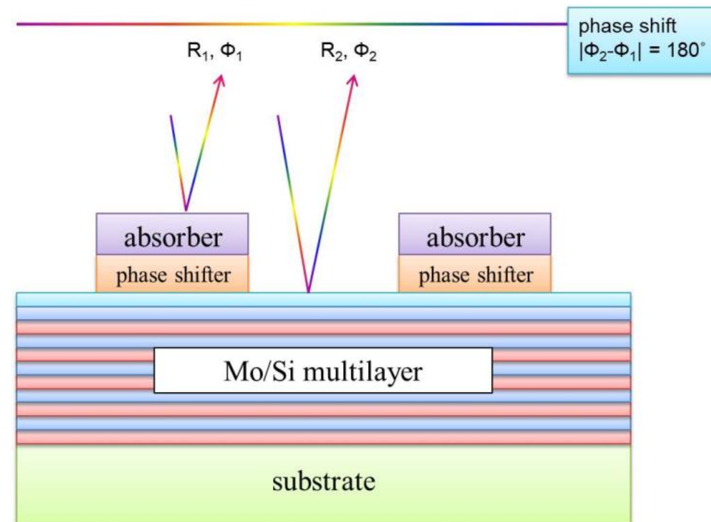


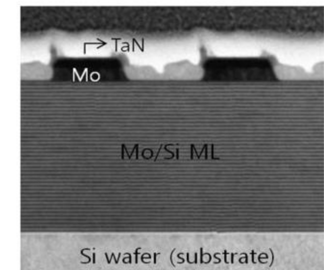
Schematic design of BIM & PSM



Conventional
binary intensity mask (BIM)

Attenuated
Phase-shift mask (PSM)





Attenuated phase-shift mask (PSM)

What is the mask shadowing effect?

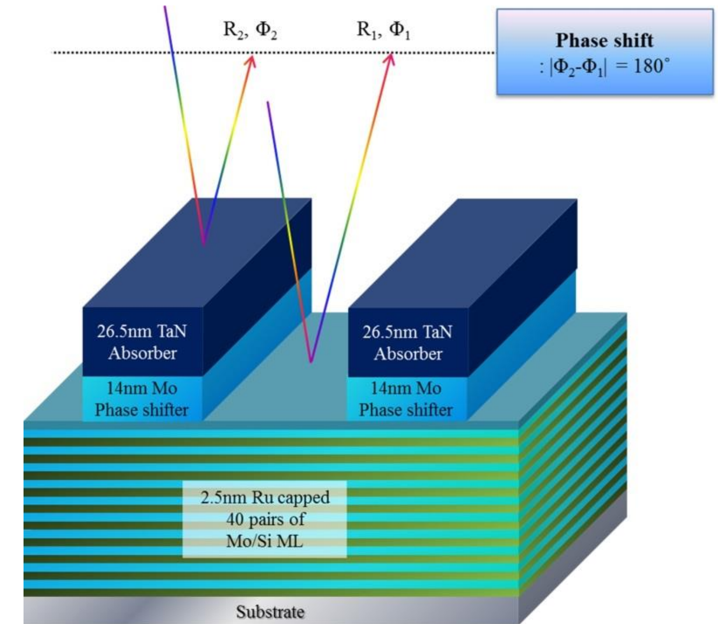
● The illumination beam is shadowed by edge of absorber
→ The effective mask CD is changed.
→ Printed pattern biased.

What is the photon shot noise effect?

● The statistical fluctuations between photon and photo resist (PR)
→ Exposure dose & Diffraction Intensity ratio → number of quanta
→ Small number of quanta → Large shot noise effect
→ More serious for EUV lithography.
→ Results in degradation of CDU, LER(CER)

So, we propose an attenuated Phase Shift Mask (PSM)!

→ 40.5nm absorber stack (26.5nm of TaN / 14nm of Mo)
→ ~6% reflectivity at absorber stack and 180° phase shift
→ Mitigate mask shadowing effect
→ Mitigate photon shot noise effect



Schematic image of the proposed attenuated PSM

Thank you for listening