

EUV mask blank development at LETI : latest results

Service Technologies des Composants Optoélectroniques

J. Hue, E. Quesnel, V. Muffato and C. Pellé
 LETI/CEA.G-DOPT, 17,rue des martyrs, 38054 Grenoble Cedex 9, France
 e-mail : hue@chartreuse.cea.fr

Laboratoire Technologies des Couches Minces

Main goals

- 1-To decrease the number of defects induced by the process on EUV blanks
 - 2-To understand the mechanisms of particle generations
 - 3-To detect PSL of 50 nm on silicon substrates
 - 4-To warranty the thermal and mechanical stability of Mo/Si multi-layer stacks
 - 5-To develop counting cross characterizations on substrates, EUV blanks,...
- (Let us know if you are interesting, ...)

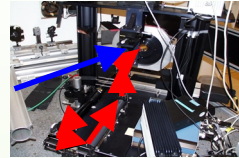
Facilities

IBS deposition



Dedicated counting metrology : COMNET (on-going transfer to Xenocs)

Present sensitivity : **90 nm** on opaque component
140 nm on fused silica

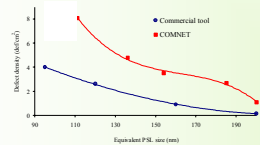
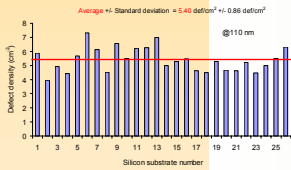


COMNET detects the defect whatever the substrate material, the substrate shape and the sample size

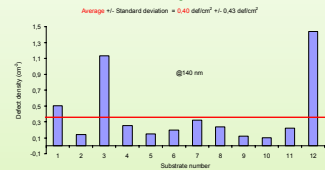
Possibility to study laser cleaning

Defect densities : typical results

(Circular) 200 mm silicon substrates

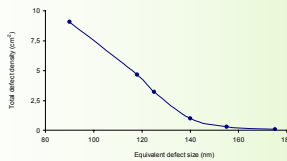
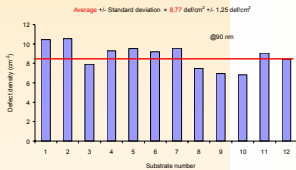


6 inches square glass substrates (Fused Silica)



Conclusion : Typical defect density @110 nm : 80% of COP's [1]

EUV Blank on fused silica : preliminary results



Total defect density : **3.7 def/cm² @110 nm**

Defect density @140 nm on fused silica (before deposition) : 1.1 def/cm²

Added defect ≤ 3.7 def/cm² – 1.1 def/cm² = **2.6 def/cm² @110 nm**

Similar mirrors on Silicon @110 nm :

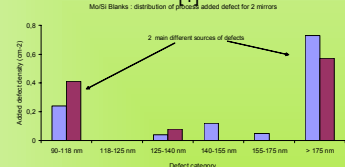
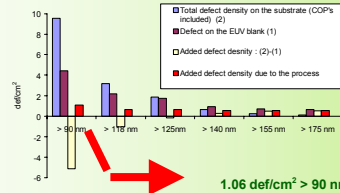
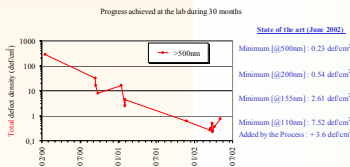
Added defect by the process : **between 1.4 def/cm² and 2.0 def/cm²**

[1] : EUV Mask Blank : defect detection at 100 nm, J. Hue and al. , SPIE Vol.5037 pp860-871

Added defect ≠ Added defect by the process

Since most of the Cop's are **hidden** by the process [1]

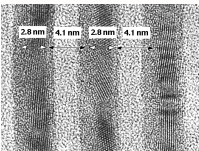
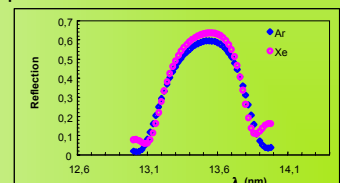
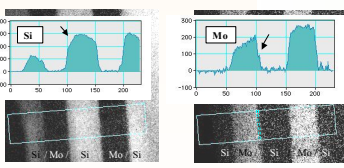
EUV Blank on silicon substrate → typically ≈ 1 def/cm² @90nm



Material studies versus process parameters (sputtering gas, pressure, energy...)

- ⇒ Coating microstructure (HRTEM) and associated chemical profiles [2]
- ⇒ Mechanical stress of single and multilayers
- ⇒ Mechanical stability

[2] : Study of IBS Mo/Si mirrors, E. Quesnel and al. , to be published in SPIE Vol.5250



Studies achieved within PREUVE and Extumask (Medea + program)