

Contamination Control Program at EUVA

IEUVI Contamination and Optics Lifetime TWG

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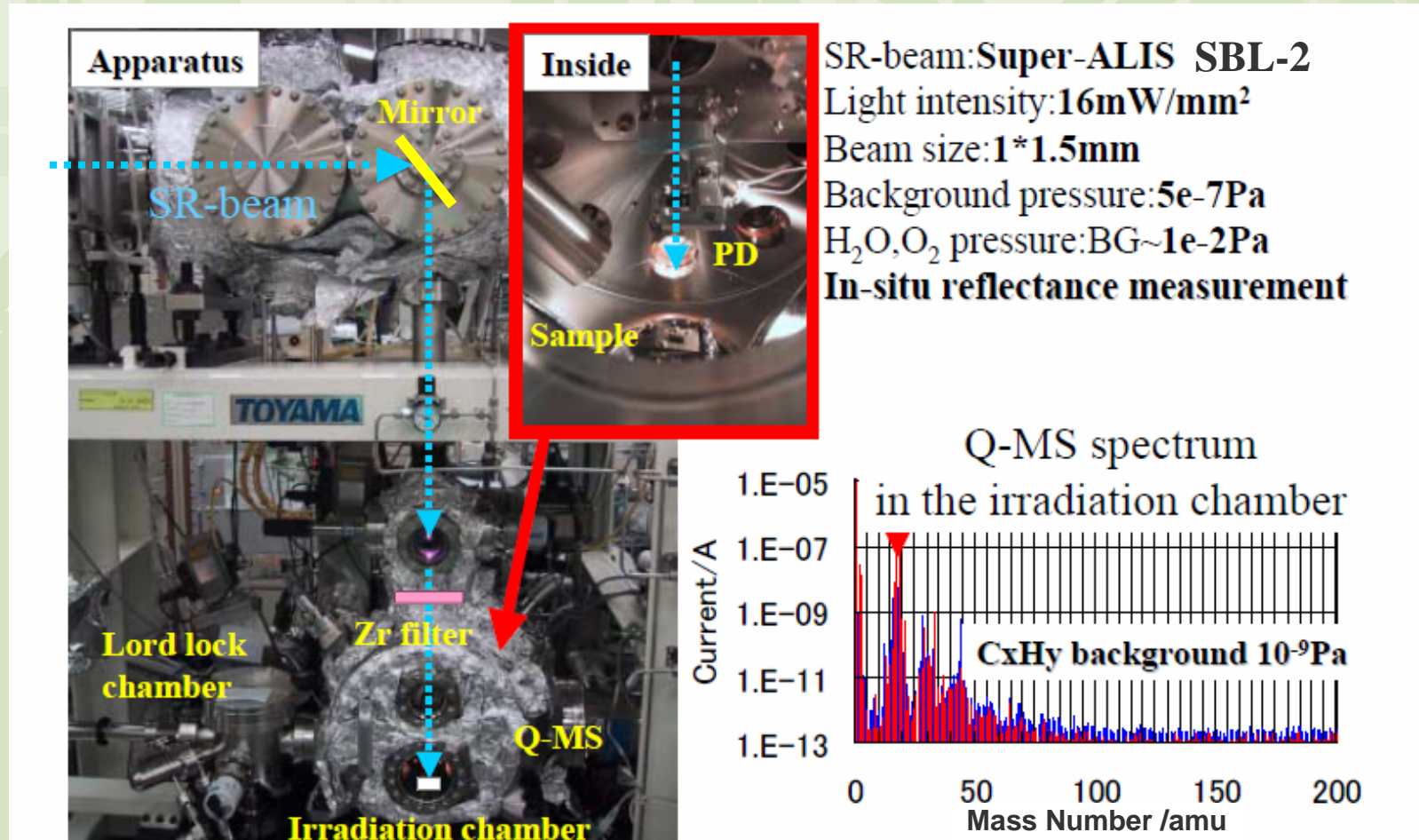
Purpose

1. To suppress reflectivity loss due to oxidation
2. To suppress carbon deposition
3. To establish cleaning method of carbon

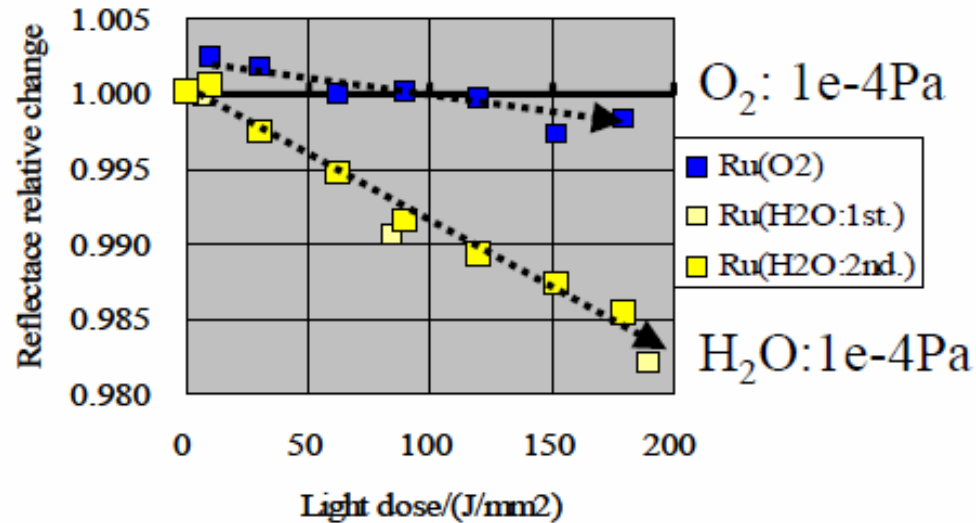
About my talk

- This talk deals with experiments with water, irradiation flux, and accumulated dose.
- Ru oxidation and effects on hydrocarbon is given by Dr. Gomei in this session.
- And relevant papers are presented by
 - Kakutani (3-CC-15, Oral) and
 - Matsunari & Aoki (3-CC-23, Oral)in the Symposium.

Experimental setup



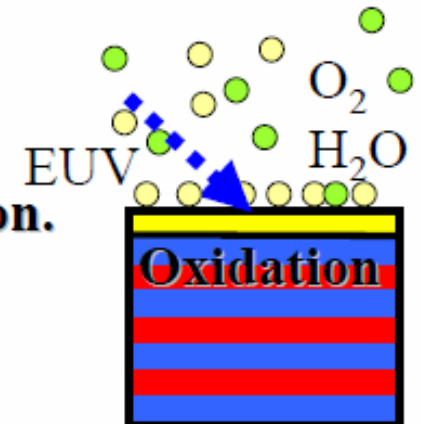
Reflectance degradation by water and oxygen



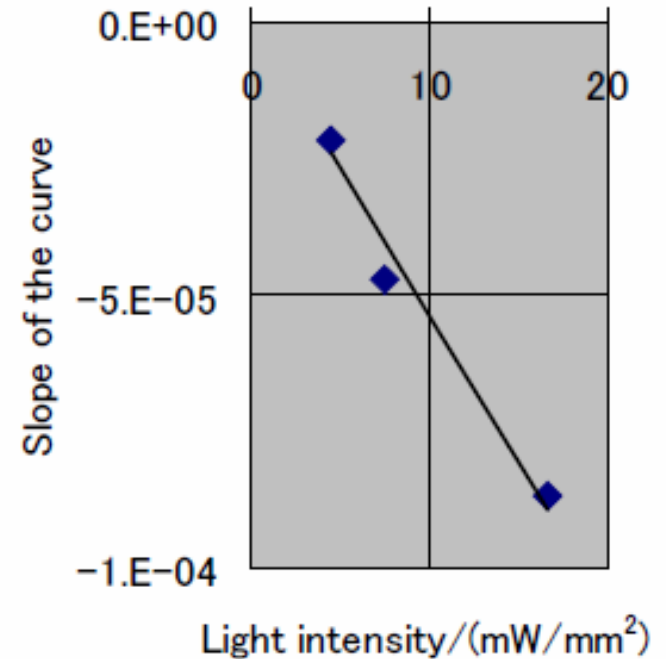
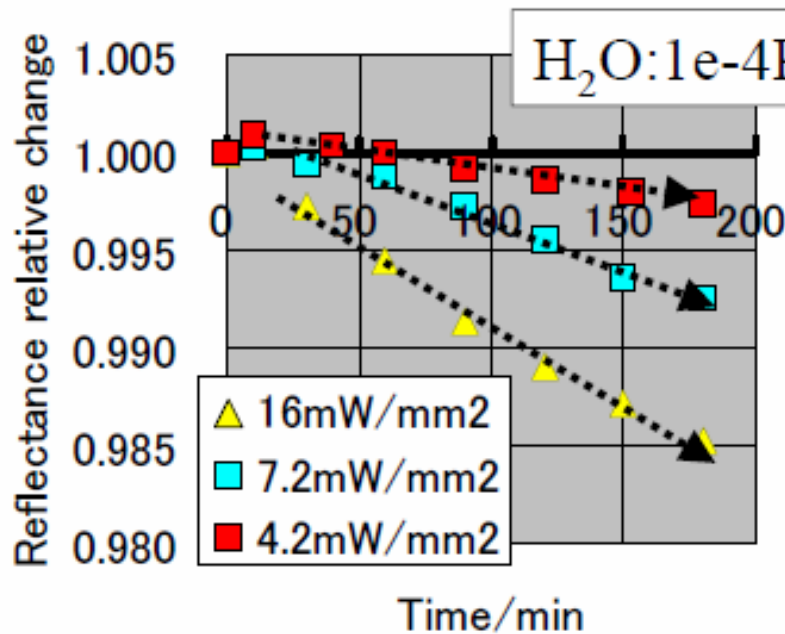
>H₂O is more effective to reflectance degradation.

<H₂O is absorbed to the surface more easily.

>We focus on the oxidation by EUV+H₂O.

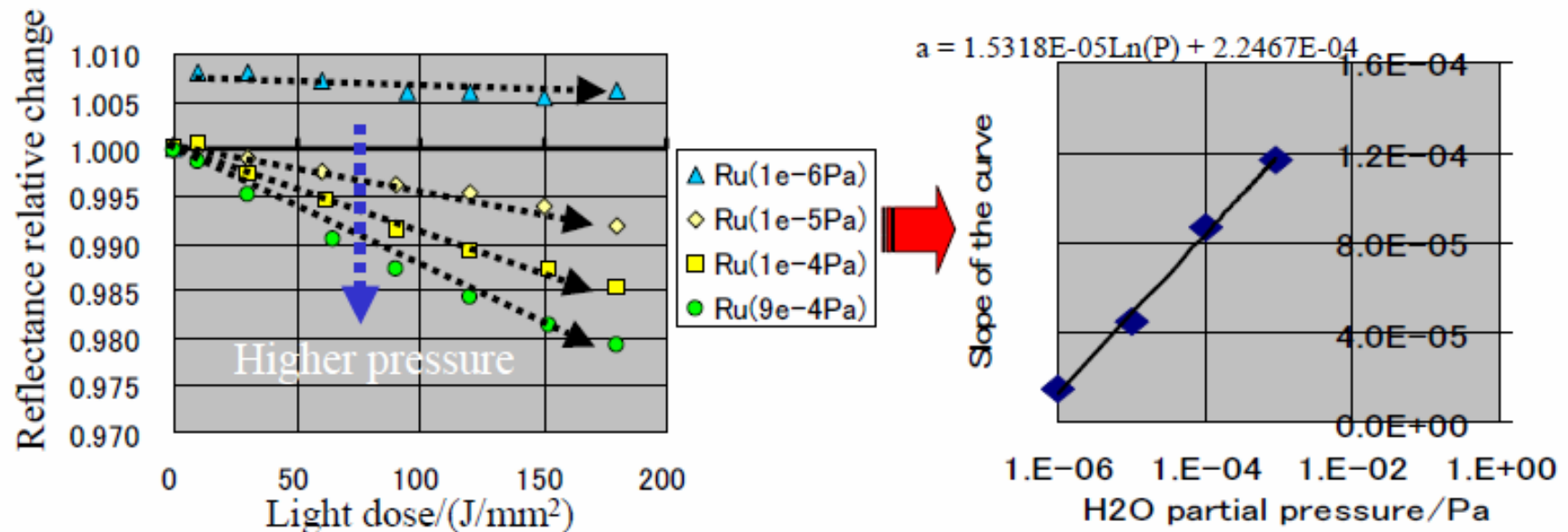


Reflectance degradation dependence on light intensity and dose



> Reflectance degradations depend on light intensity and light dose linearly.

Reflectance degradation dependence on water partial pressure

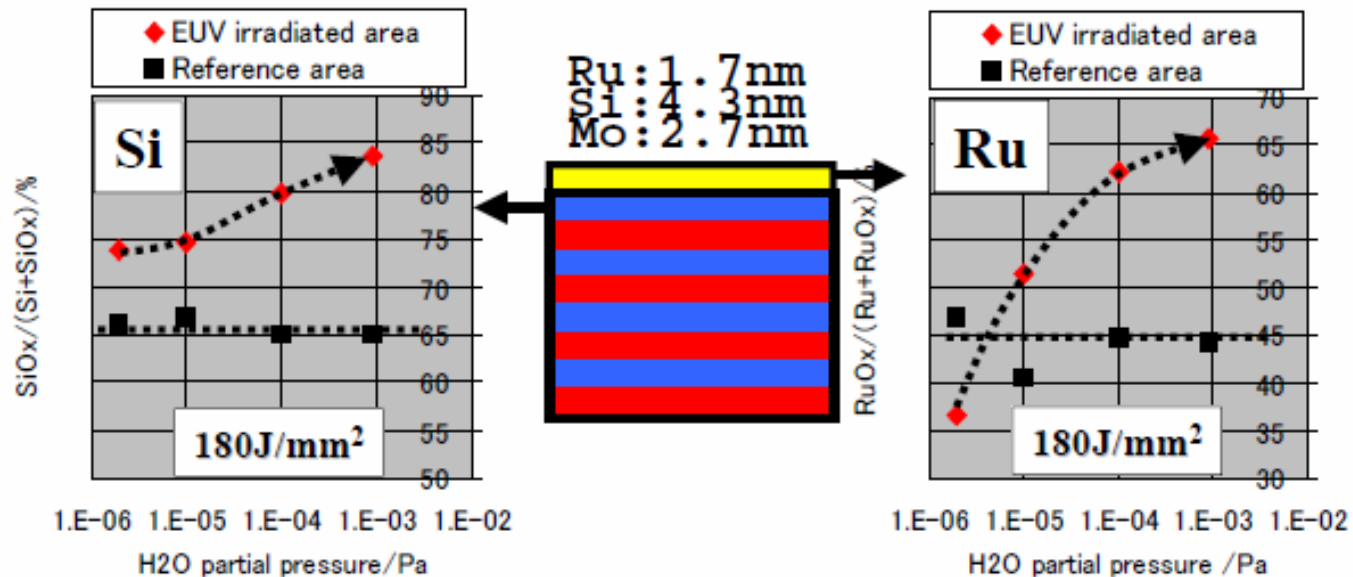


- > Reflectance degradations depend on H₂O pressure logarithmically.
- > Prediction of reflectance degradations/Lifetime estimation

$R/R_0 = 1 - (b \cdot \ln(P) + c) I t$, R:reflectance/%, P:H₂O pressure/Pa, It:light dose/(J/mm²)

b:1.53e-5,c=2.25e-4 in this Ru-Cap sample.

Oxidation speed dependence on water partial pressure, light dose, and intensity



- > **Ru and Si in Ru-Cap are oxidized by EUV irradiation.**
- > **Oxidation speeds depend on H₂O partial pressure and light dose.**

Summary

- ▶ Oxidation speed and reflectance degradation dependence on light intensity, H_2O partial pressure and light dose are studied.
- ▶ Prediction of reflectance degradation may give a clue of lifetime of optics.