

Outgassing Measurement Status (Infineon, Elettra)

March 3rd, 2005; San Jose, CA

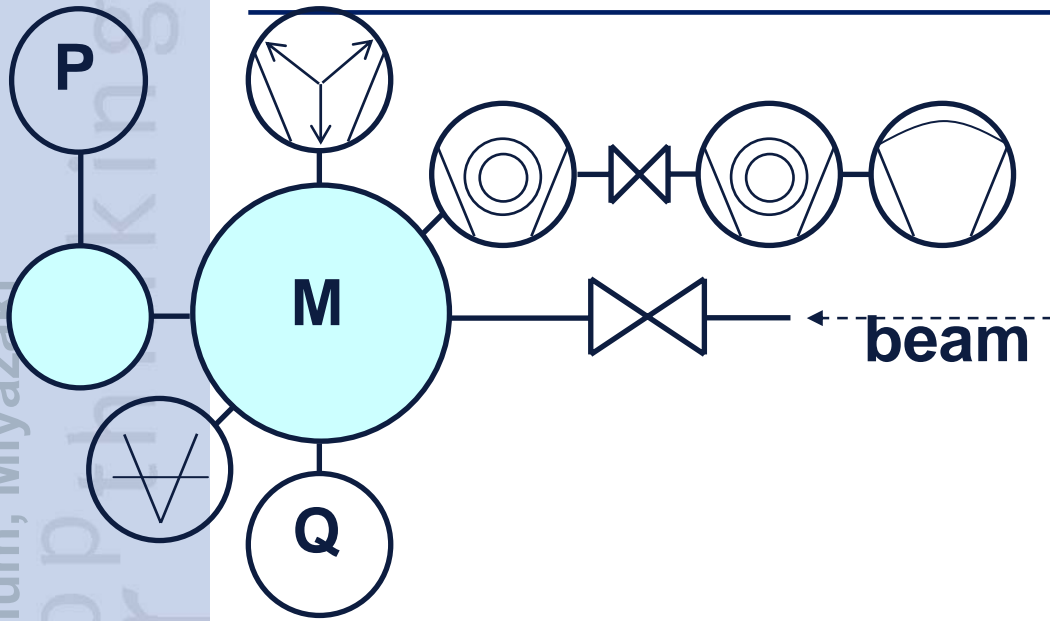
IEUVI Resist TWG

W. D. Domke



Never stop thinking.

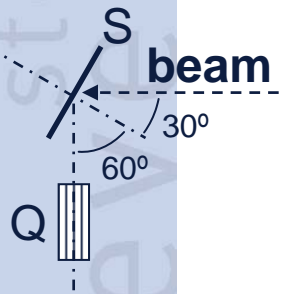
Experimental – EUV outgassing setup



Legend:

- M - main chamber
- P - photodiode
- Q - quadrupole mass spectrometer
- S - sample

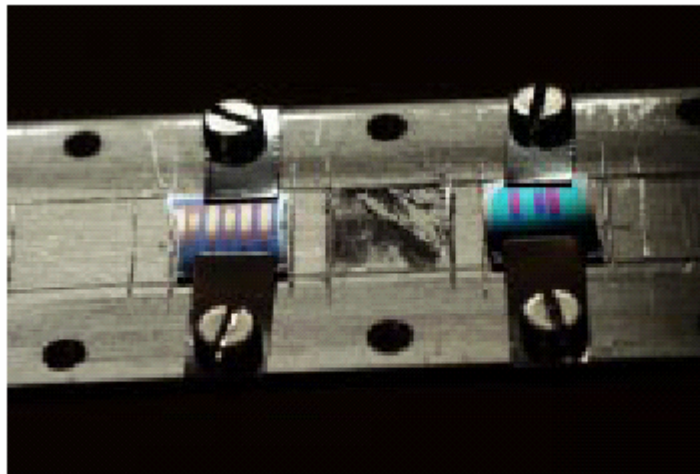
- ion pump
- turbomolecular pump
- diaphragm pump
- inverted magnetron gauge
- valve



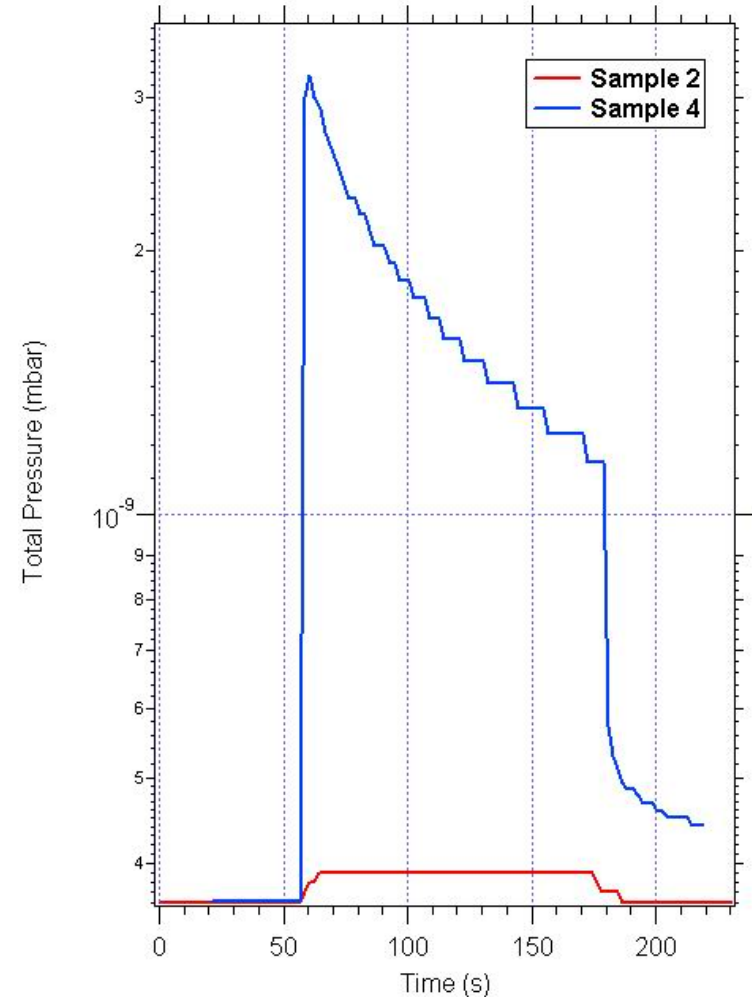
- EUV beam incidence on resist on silicon samples was at an angle of 30 °
- quadrupole mass spectrometer was located at 60°, distance from wafer was 15 mm.
- chamber volume is 3.1 liter
- EUV outgassing is sampled at different spots of a coated wafer to allow fast mass spectrometer scanning (10 amu channels per exposure); spot size was 2.5 x 0.5 mm

Measurement of EUV total outgassing

- Total outgassing pressure (10^{-9} mbar) is integrated over a total exposure time of 2 min.
- total outgassing of different resist samples varied by 3 orders of magnitude; low outgassing resists resulting in 10^{+12} molecules/cm² sec

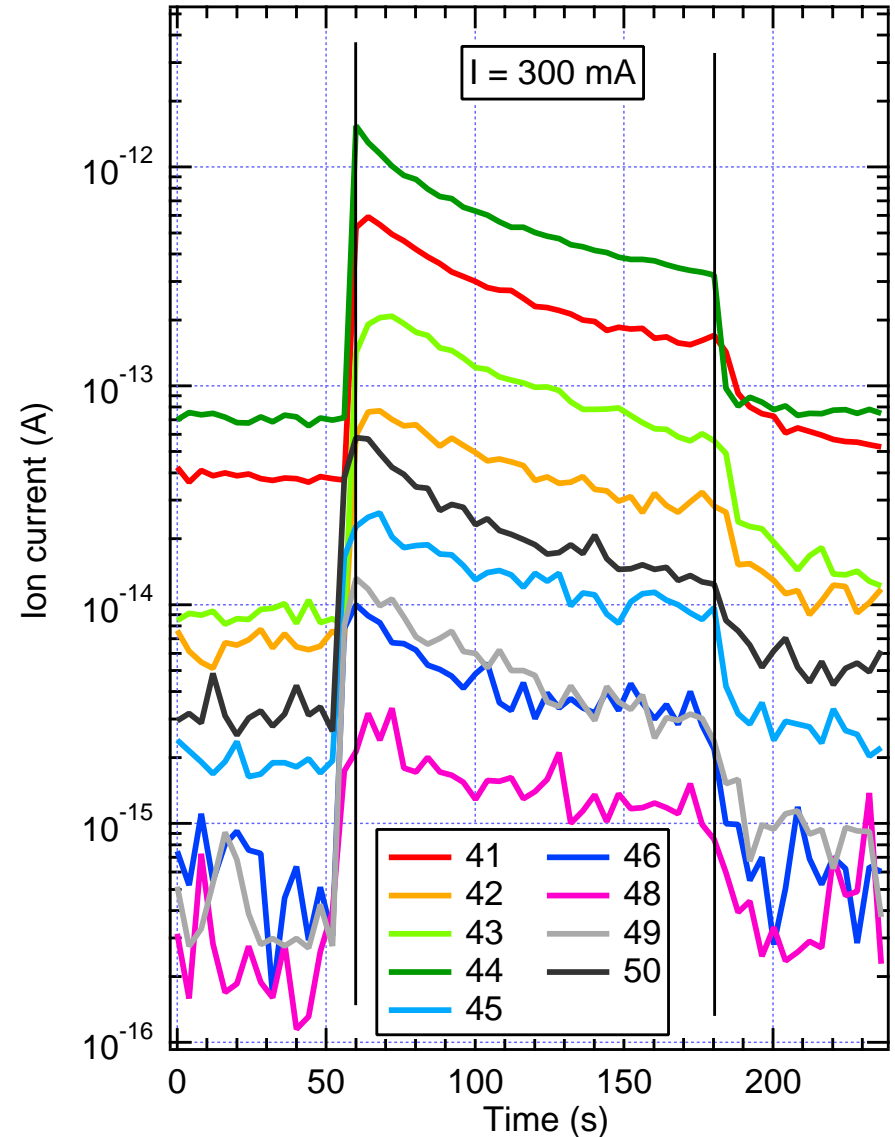


*Resist samples subject to degassing tests.
The illuminated parts are recognizable by the change in colour induced by photochemical interaction with radiation.*



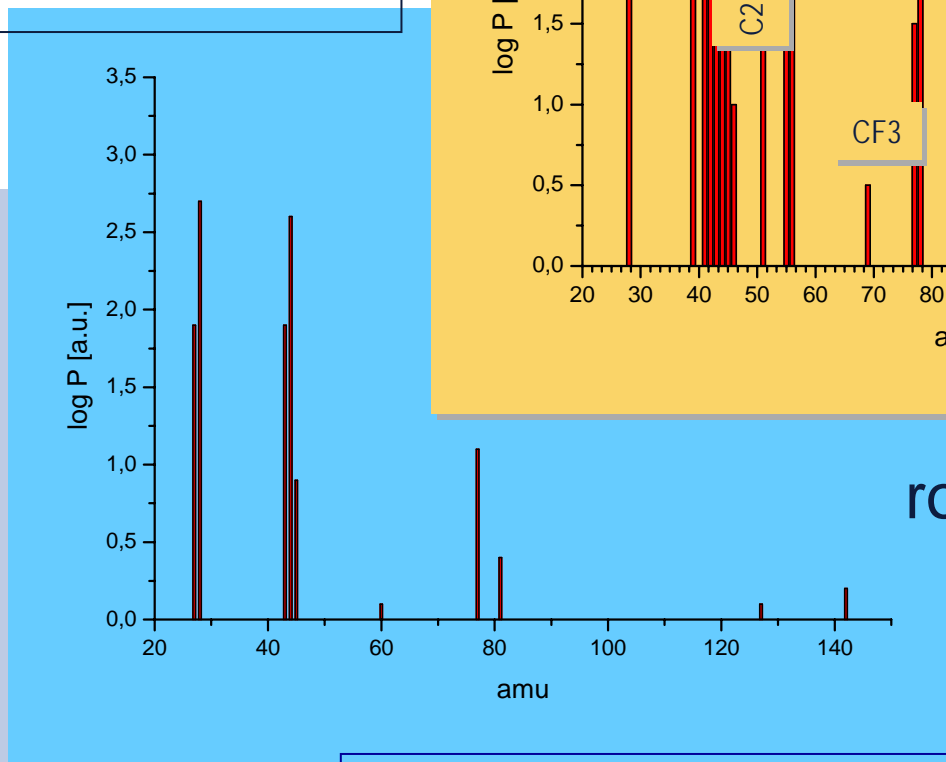
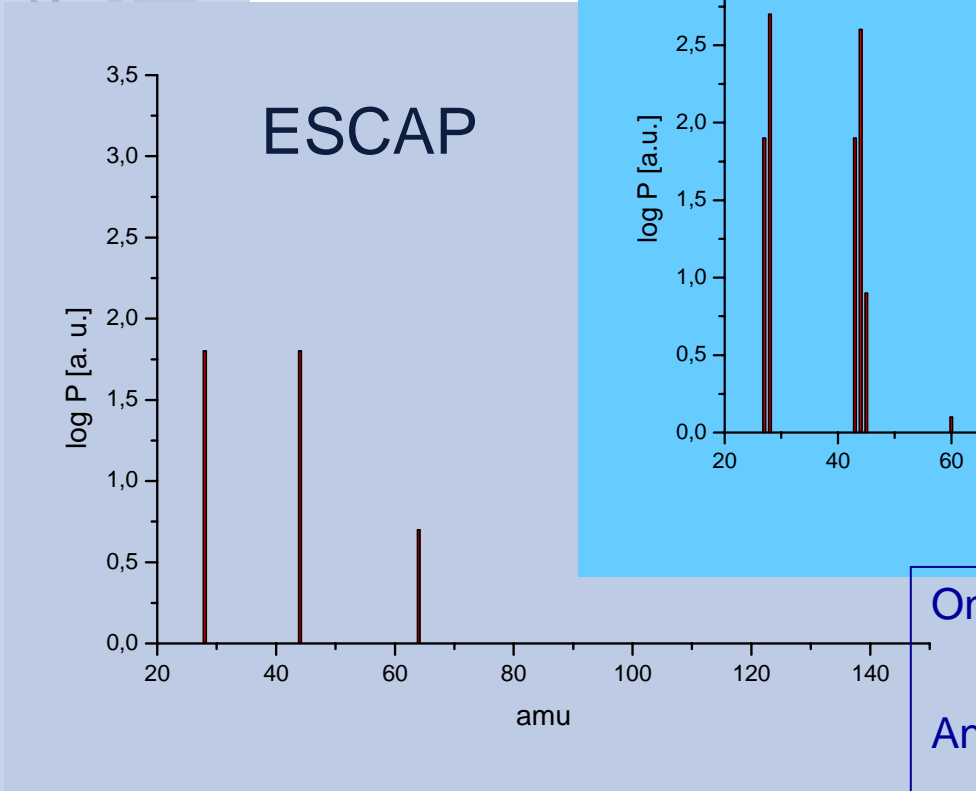
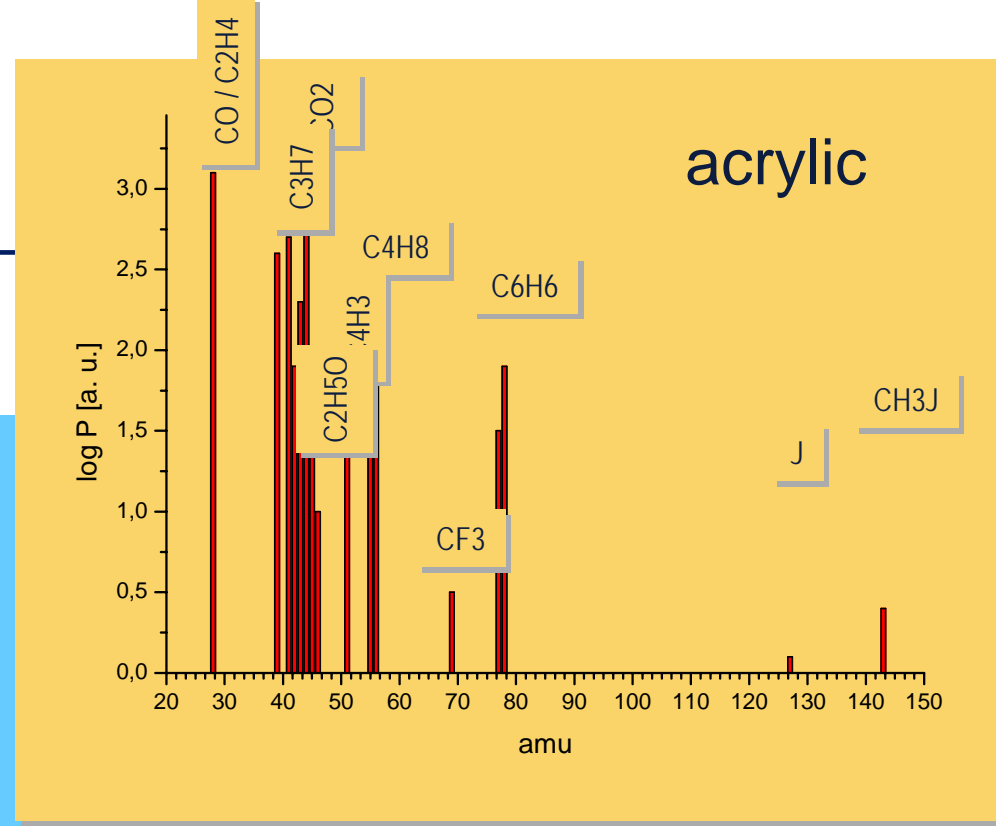
Evaluation of mass spectra

- Samples are exposed for 120 sec
- 10 mass channels are measured simultaneously
- time-dependent mass signals are evaluated per peak value or per integral
- mass spectra are then reconstructed from all available channels



EUV fragments comparison

The highest outgassing fragments are deblocking group fragments and CO₂



One order of magnitude less is the outgassing of PAG fragments and polymer chain fragments
 Another order of magnitude less is the outgassing of iodine-containing fragments from the PAG

Advantages/Disadvantages



- Easy Online Setup
- high EUV power
- only in-band (13.4nm) radiation



- only few synchrotron exposure slots available
- high time consumption of total evaluation
- not sensitive enough for low-outgassing materials

Remark: ***some tool supplier (ASML, Nikon)
set very different outgassing requirements***

