2ND EUVL SYMPOSIUM POSTER# 65

CHARACTERIZATION OF OUTGASSING FOR EUV TECHNOLOGY

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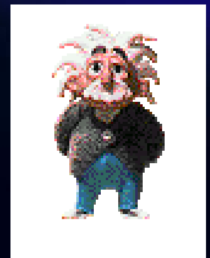
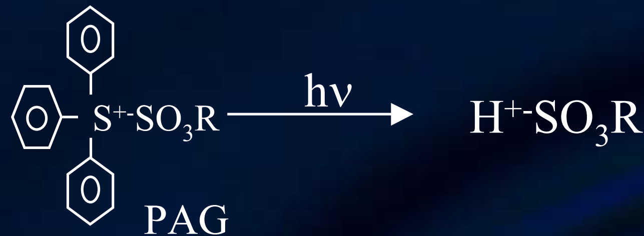


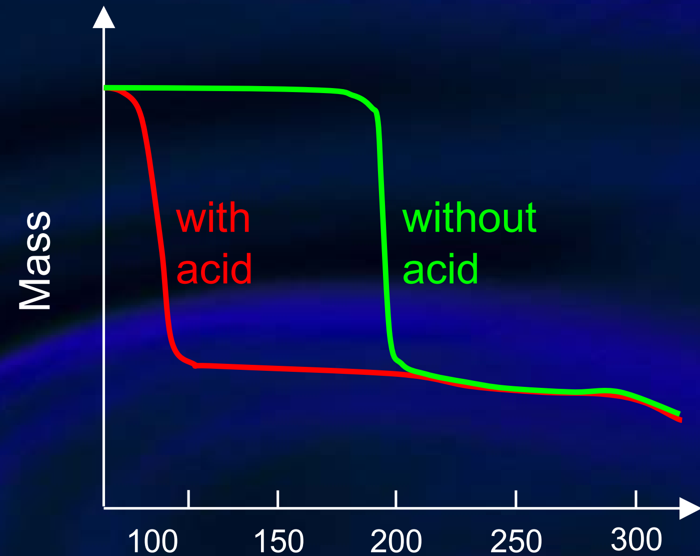
Photoresists Outgassing Introduction

- Background: Photoresist outgassing is a concern, since the outgassing materials can adhere to the optics and reduce reflectivity.
- EUV optics are more expensive than those of current technology (DUV, 193nm..)
- EUV optics exposure environments are different: under vacuum, the outgassing materials are more complicated.
- Much work needs to be completed to determine how different contaminants affect reflectivity, and whether all or any of the contamination can be cleaned from the optics.

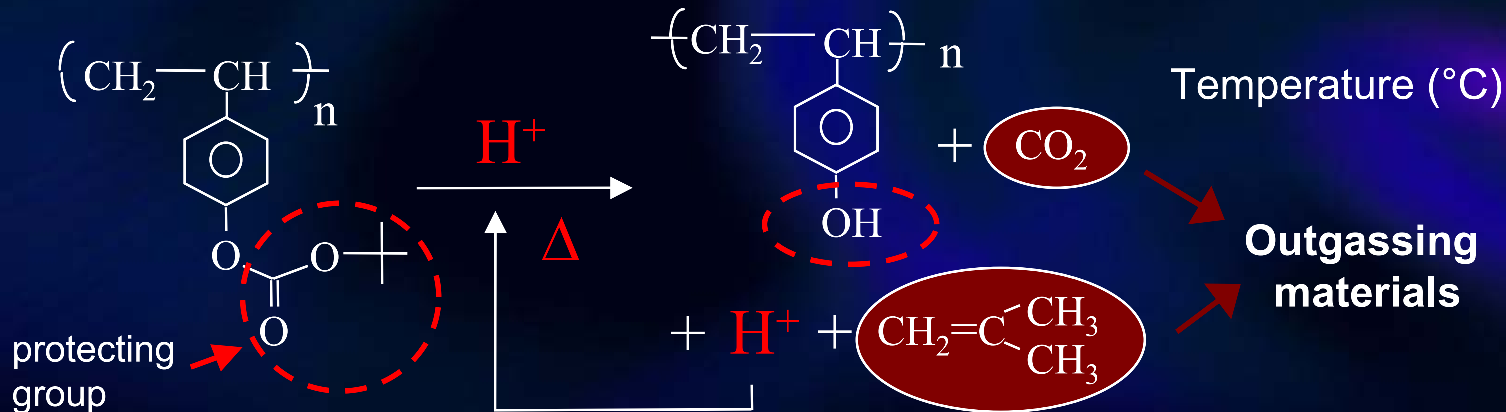
KrF Chemically Amplified Resists

Photoacid Generation

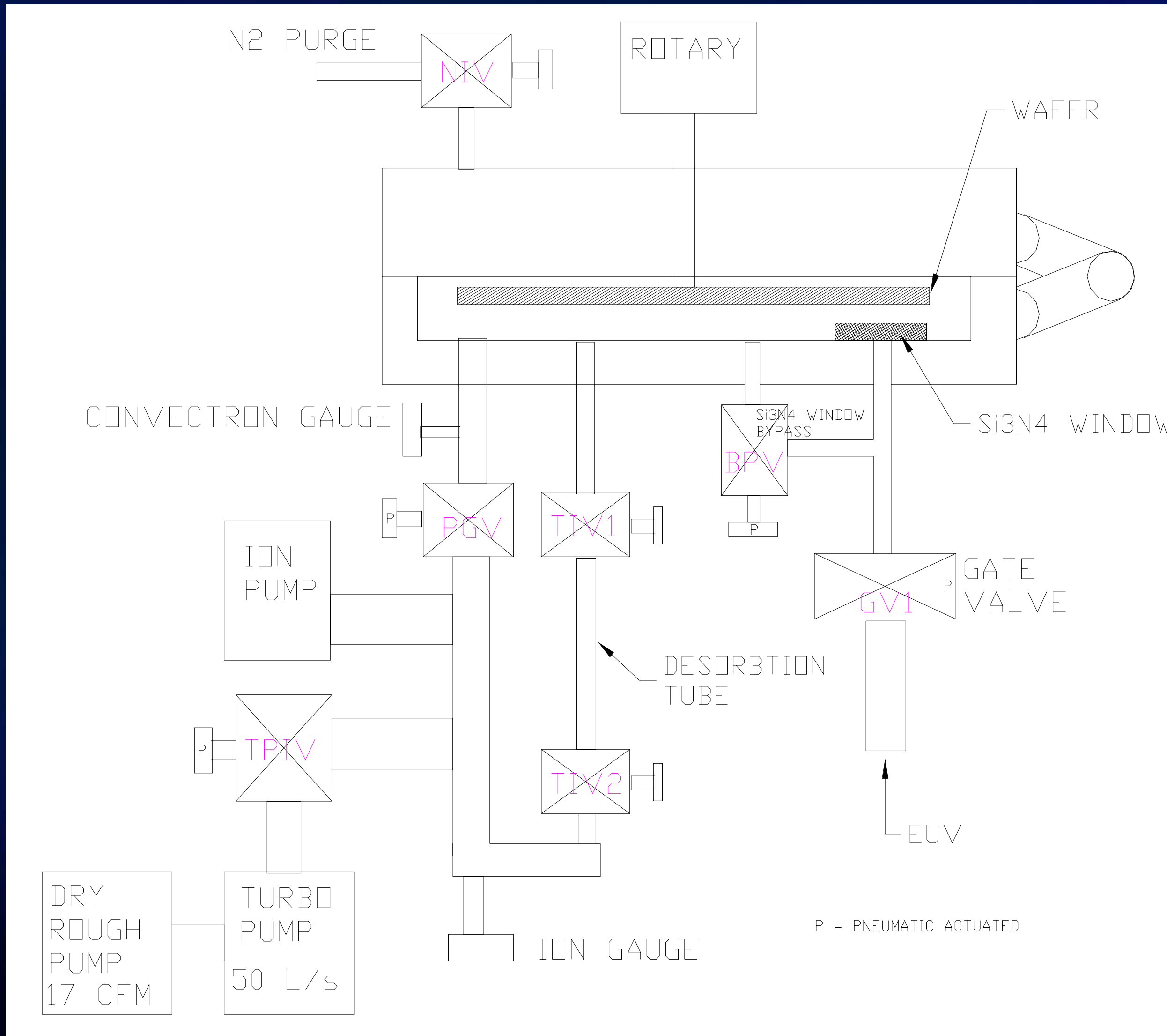




Acid-Catalyzed Deprotection

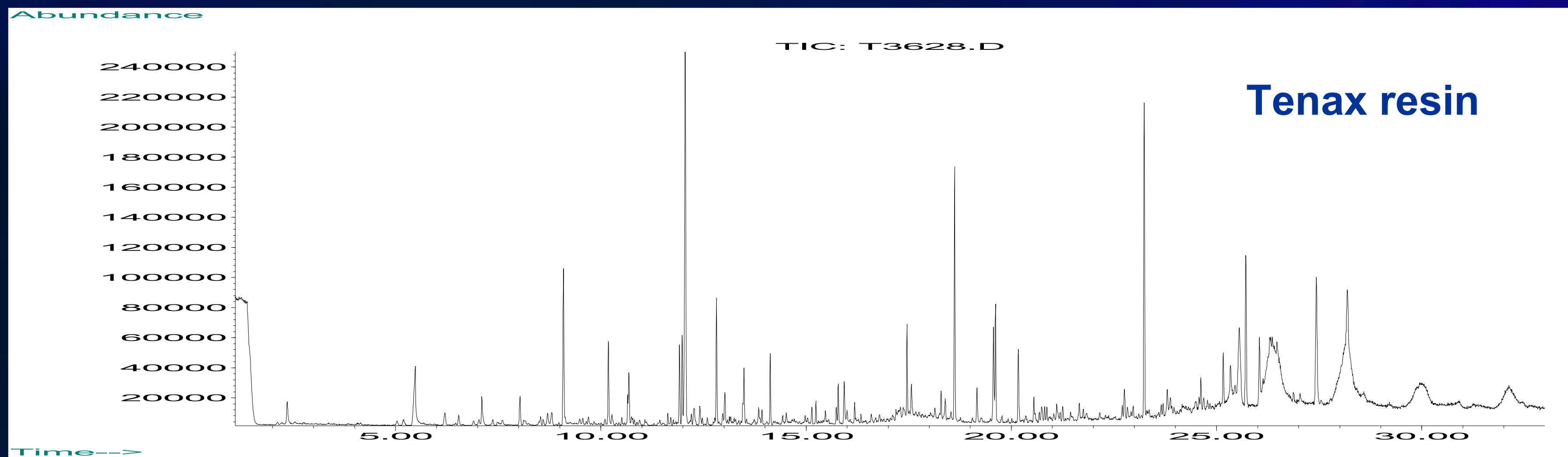


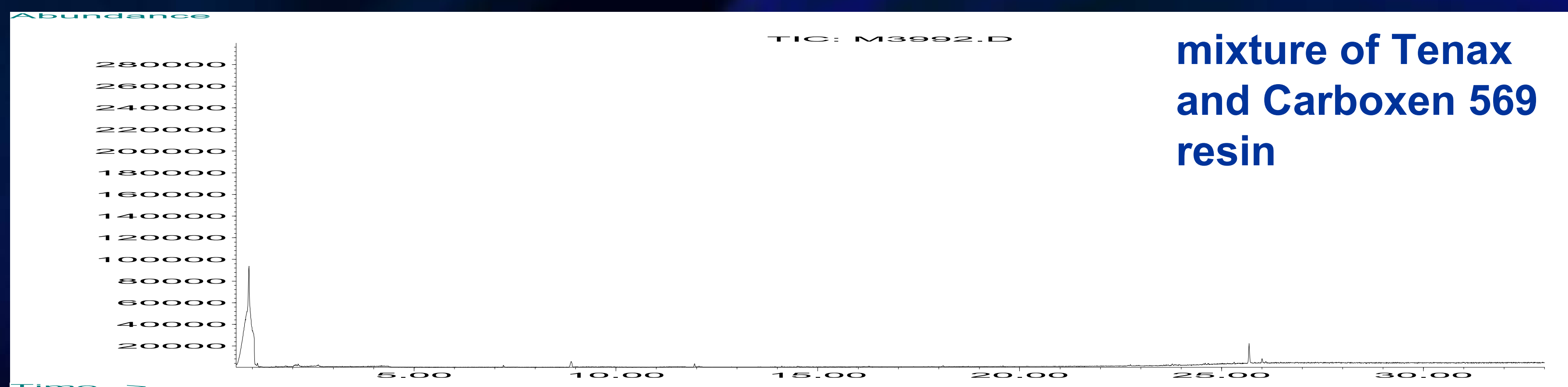
Outgassing Experiment Setup



- Place resist coated wafer in chamber, and pull vacuum.
- Expose resist to EUV.
- Purge chamber with nitrogen into absorption tube.
- Close valve to absorption tube, and remove wafer.
- Repeat with two additional wafers into a single absorption tube to amplify signal.
- Analyze outgassing contaminants using GC/MS.

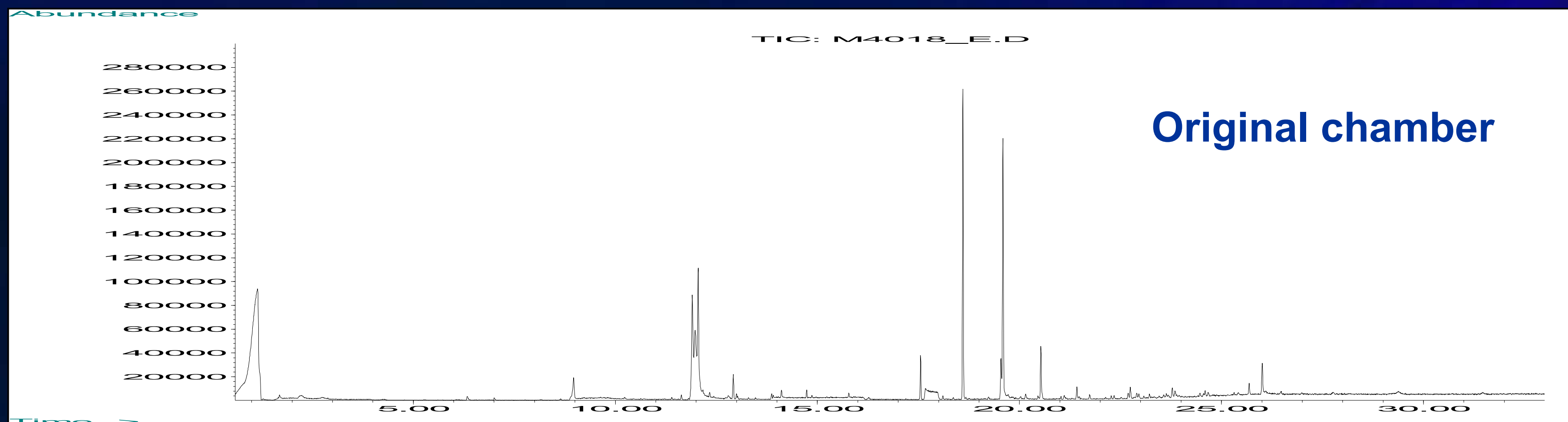
Reduction Resin Contamination

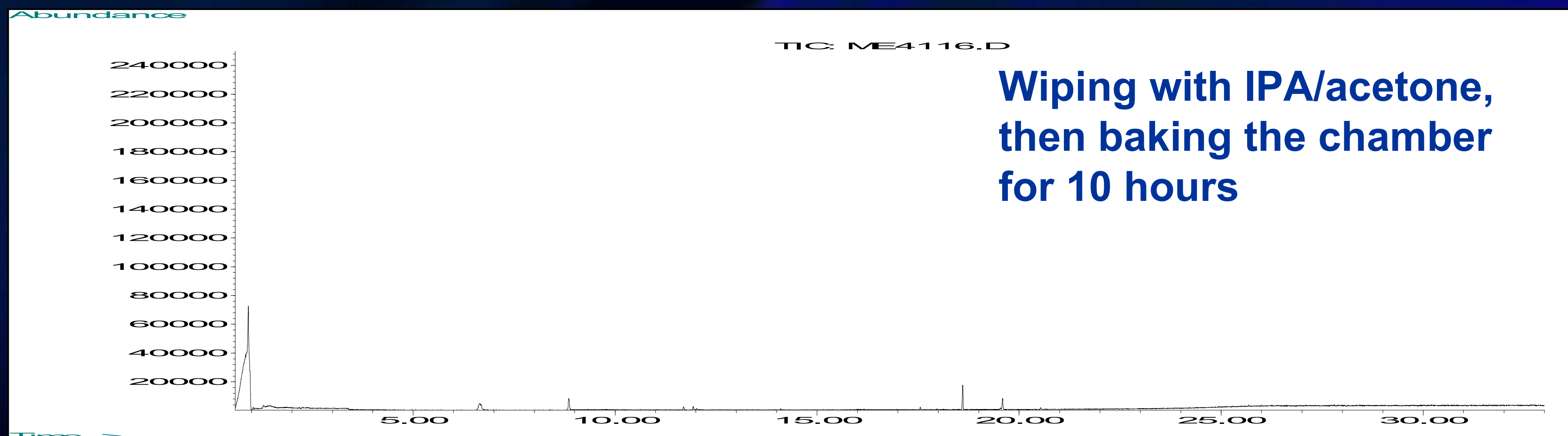




- A change in the resin of absorption tubes

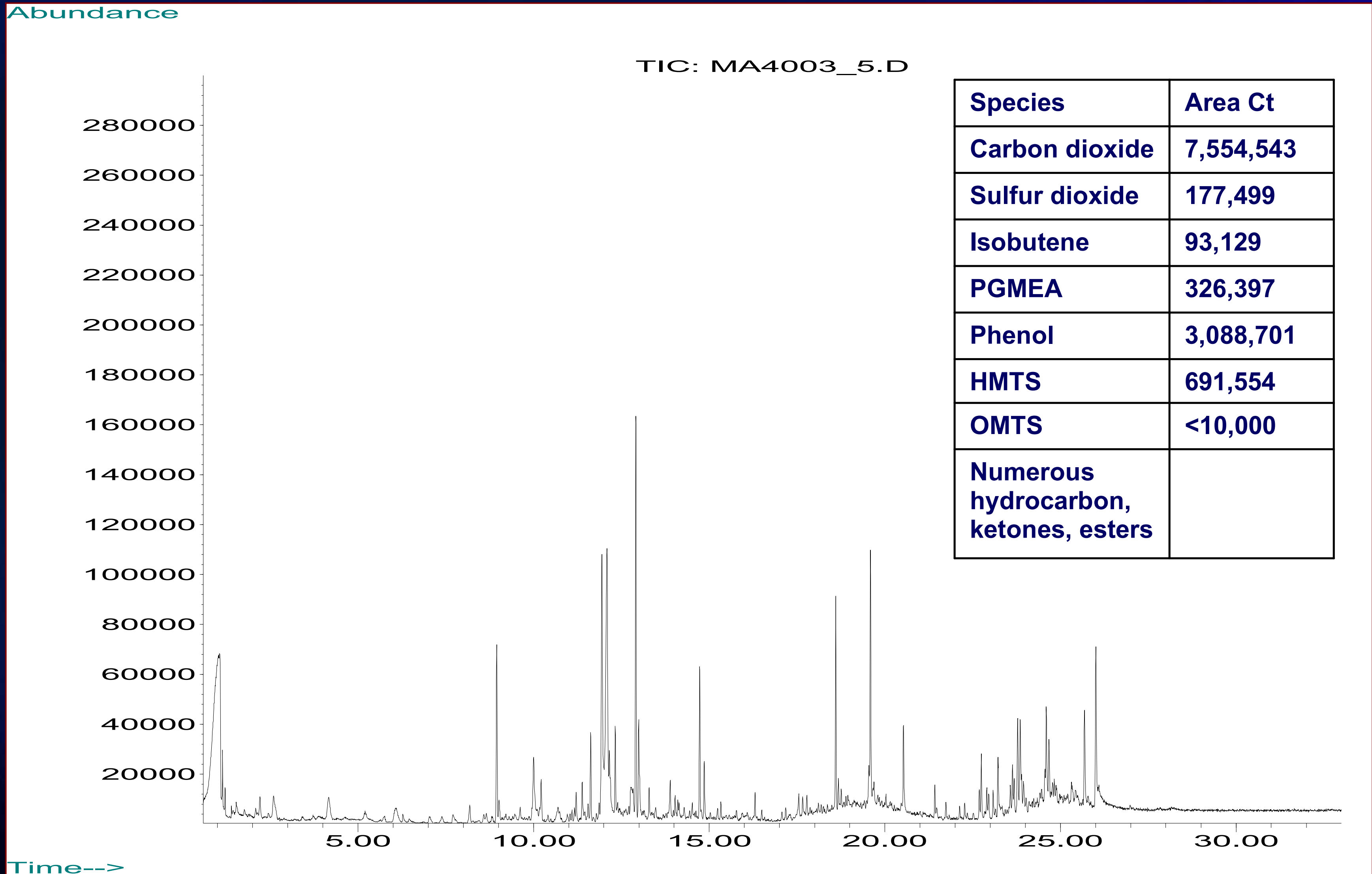
Chamber contamination





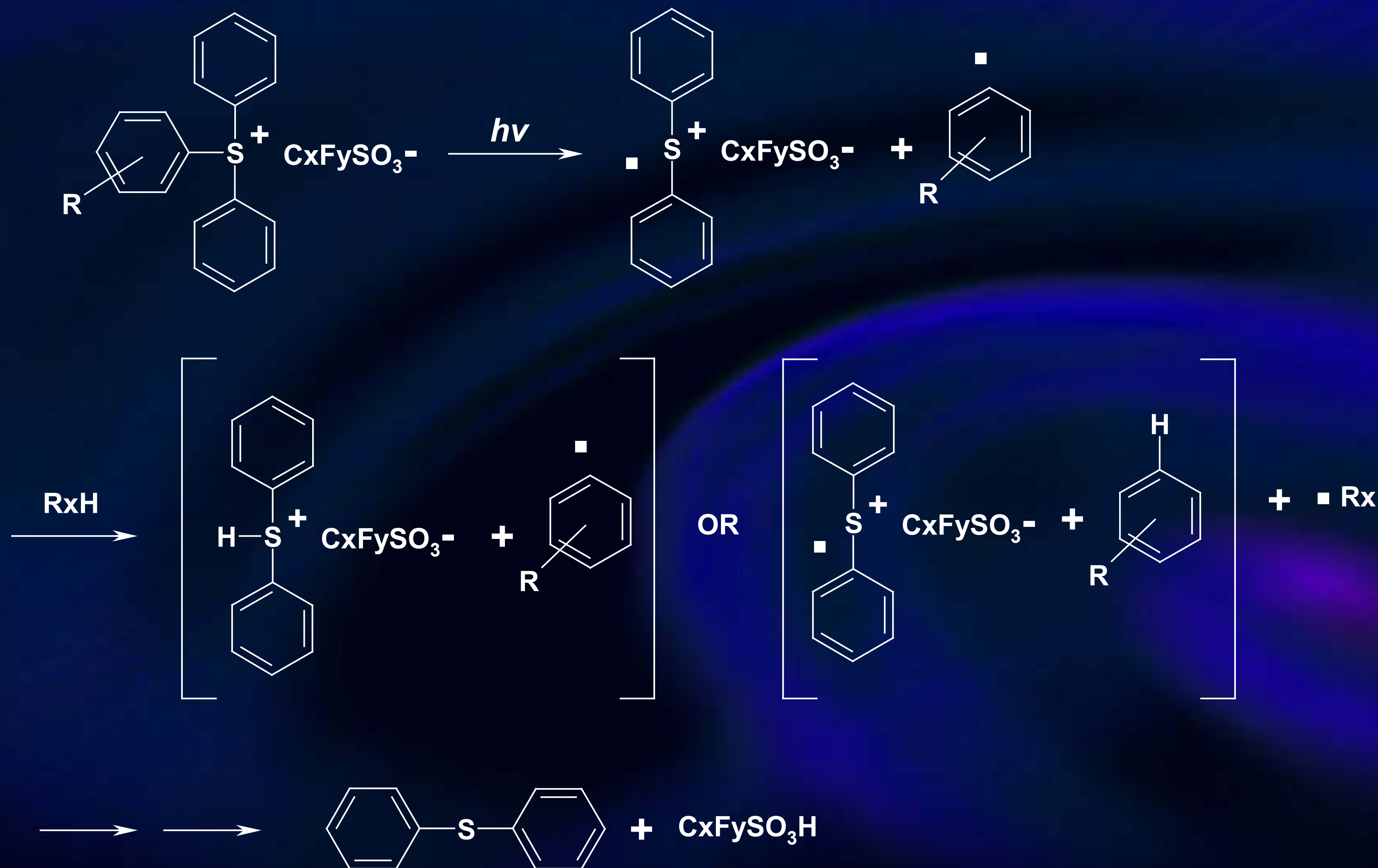
- Cleaned chamber reduces background contamination

APEX Outgassing Results



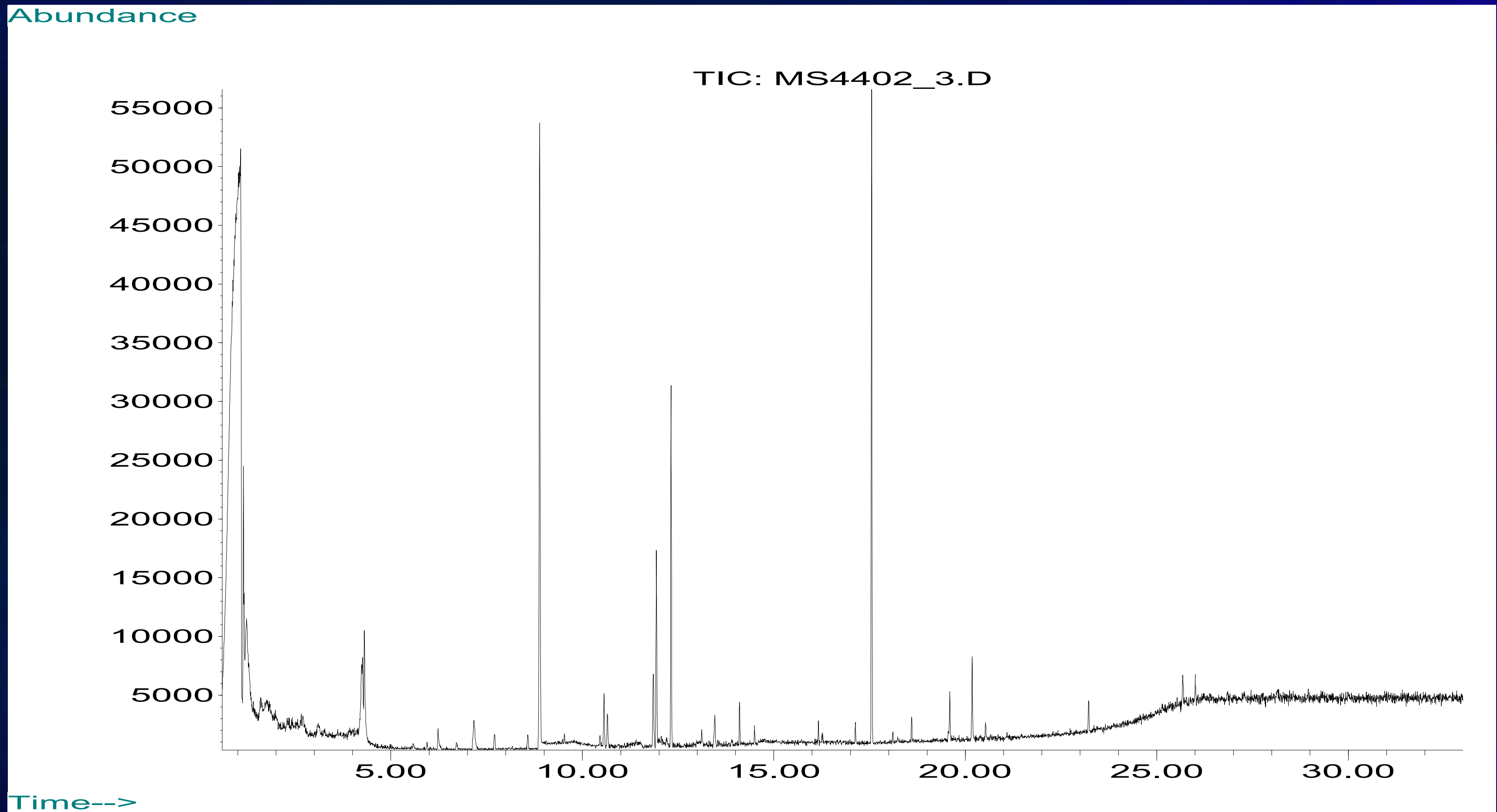
Species	Area Ct
Carbon dioxide	7,554,543
Sulfur dioxide	177,499
Isobutene	93,129
PGMEA	326,397
Phenol	3,088,701
HMTS	691,554
OMTS	<10,000
Numerous hydrocarbon, ketones, esters	

PAGs Outgassing Mechanisms



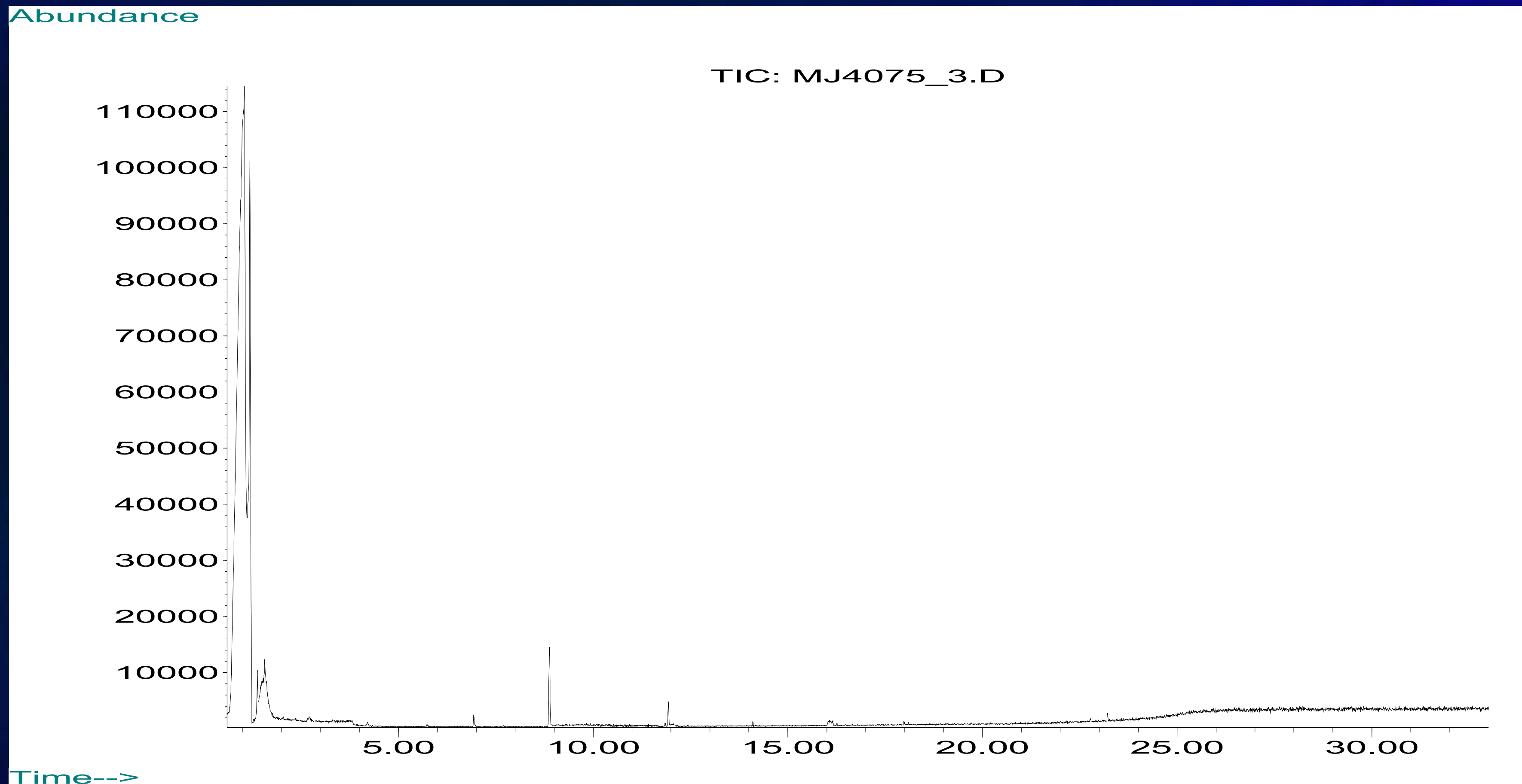
Dektar, J. L.; Hacker, N. P. *J. Am. Chem. Soc.* **1990**, *112*, 6004.

Outgassing results from A resist



- Outgassing due to PAG fragments.

Outgassing results from B resist



- Outgassing due to protecting groups

Summary

- Intel has qualified outgassing chamber / experimental procedure.
- Several EUV photoresists have been screened for EUV outgassing under vacuum exposure.
- Intel is currently completing calibration to quantify results.
- Initial data indicates that main outgassing components under EUV vacuum exposure are PAG fragments and Protecting groups.
- Basic outgassing mechanisms that have been proposed.

Acknowledgement

- University of Wisconsin
- Photoresist Suppliers