Nikon, Precision Equipment Company

Acceptable Photoresist Outgassing

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Acceptable Outgassing Rate (Presented in Last Year)

Assumption

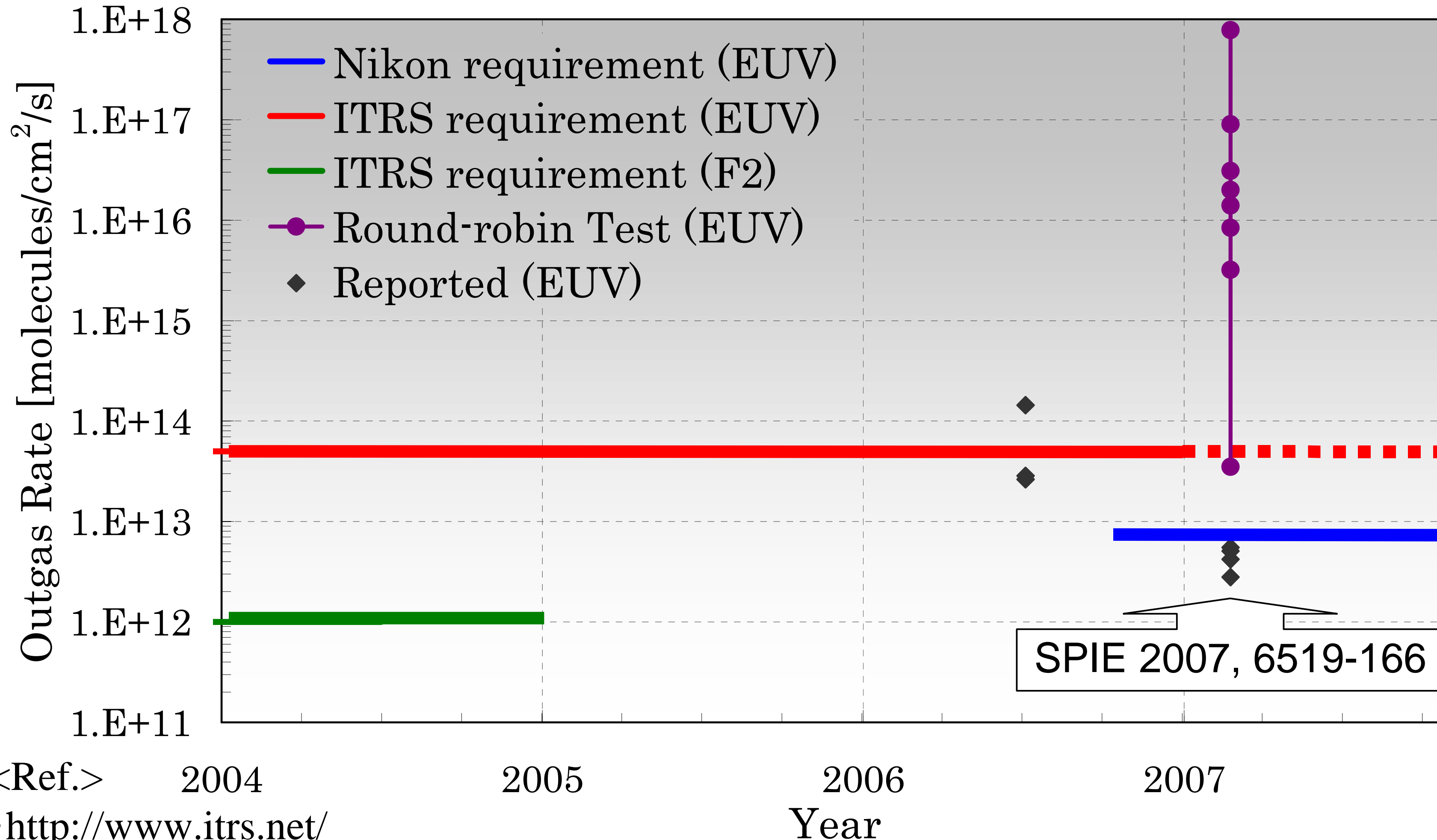
Degree of Vacuum of PO $1x10^{-5}$ Pa for H2O

$1x10^{-7}$ Pa for CxHy

Acceptable Level

	Outgassing Rate [molecules cm^{-2} s^{-1}]
H2O	$7x10^{14}$
CxHy (>44 amu)	$7x10^{12}$

History of Resist Outgassing Rate



<Ref.>

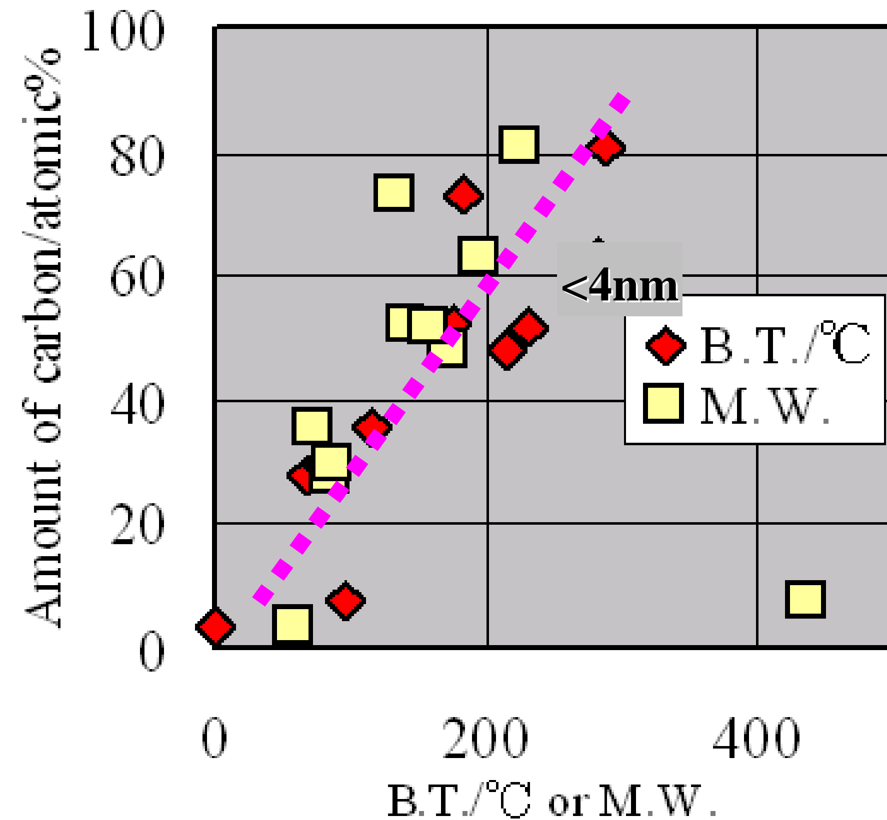
- http://www.itrs.net/
- SPIE Proceedings, 2000~2007
- EUVL Symposium, 2002~2007
- NGL Workshop, 2002~2007

Some result is equivalent or less than Nikon's requested level.

Acceptable Outgassing Rate

Presented at EUV Sympo., Barcelona

Organic gas	B.T./℃	M.W.
Buthane	-1	58
Buthanol	117	74
Methyl propionate	79	88
Hexane	69	86
Perfluoro octane	97	438
Decane	174	142
Decanol	231	158
Methyl nonanoate	214	172
Diethyl benzene	183	134
Dimethyl phtalate	283.7	194
Hexadecane	287	226



- ✓ Organic gases with higher boiling point or heavier molecular weight show larger carbon deposition rates.

Carbon Deposition

Contribution by heavier/higher BP species is greater

Summary

- Nikon's requirement of resist outgassing rate for EUV1 is 7E12 molecules cm^{-2} s^{-1} for organic gases specie.
- Nikon note that our requirement is looser than ITRS requirement for F2 (2004).
- Published outgassing rate of some of actual resist is equivalent or less than Nikon's target.
- Reducing heavier/higher BP species is essential.