



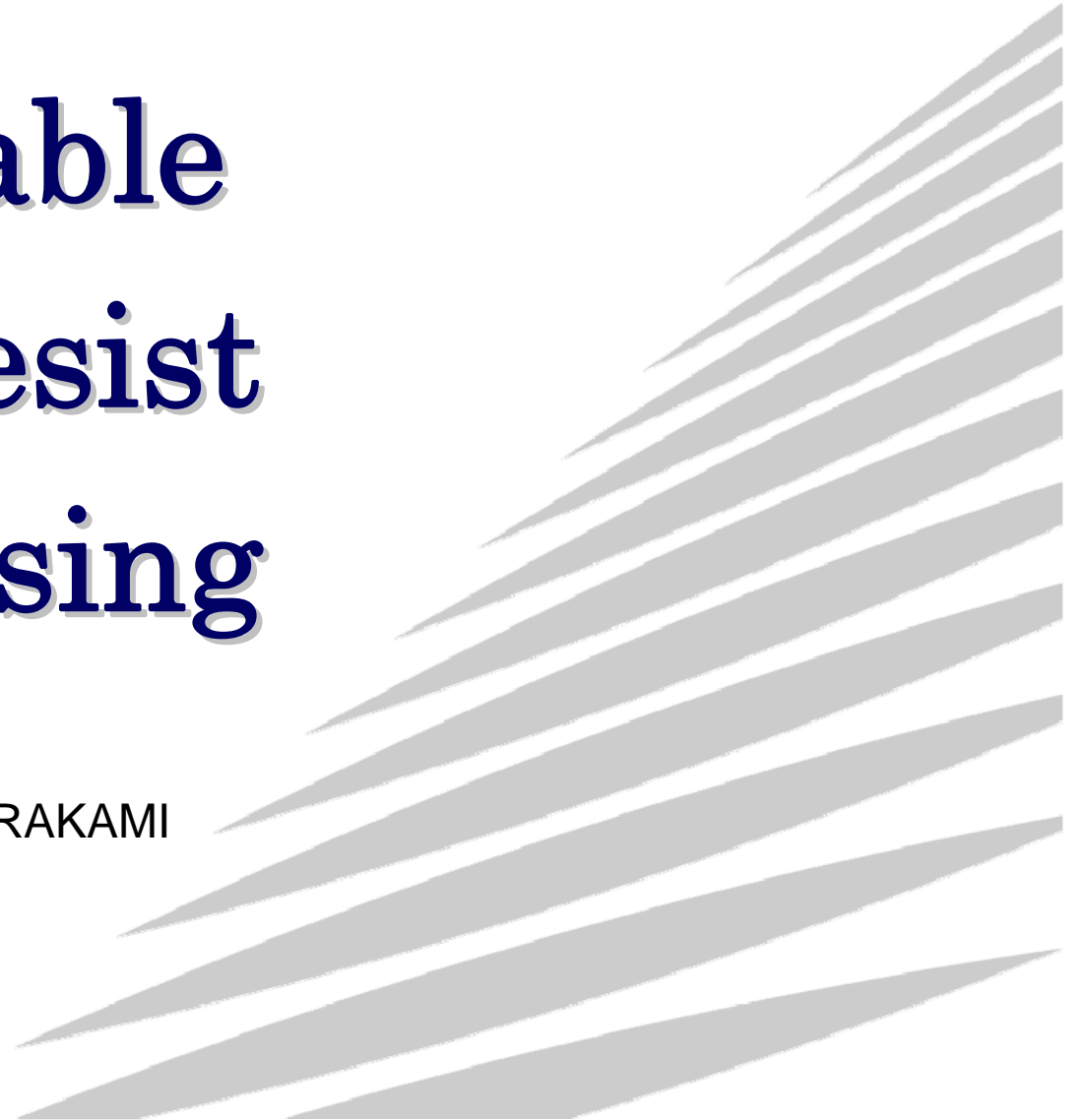
Nikon, Precision Equipment Company

# Acceptable Photoresist Outgassing

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Resist Workshop in Sapporo



# Acceptable Outgassing Rate (Presented in Last Year)

Resist Workshop  
T. Aoki/Nikon



## Assumption

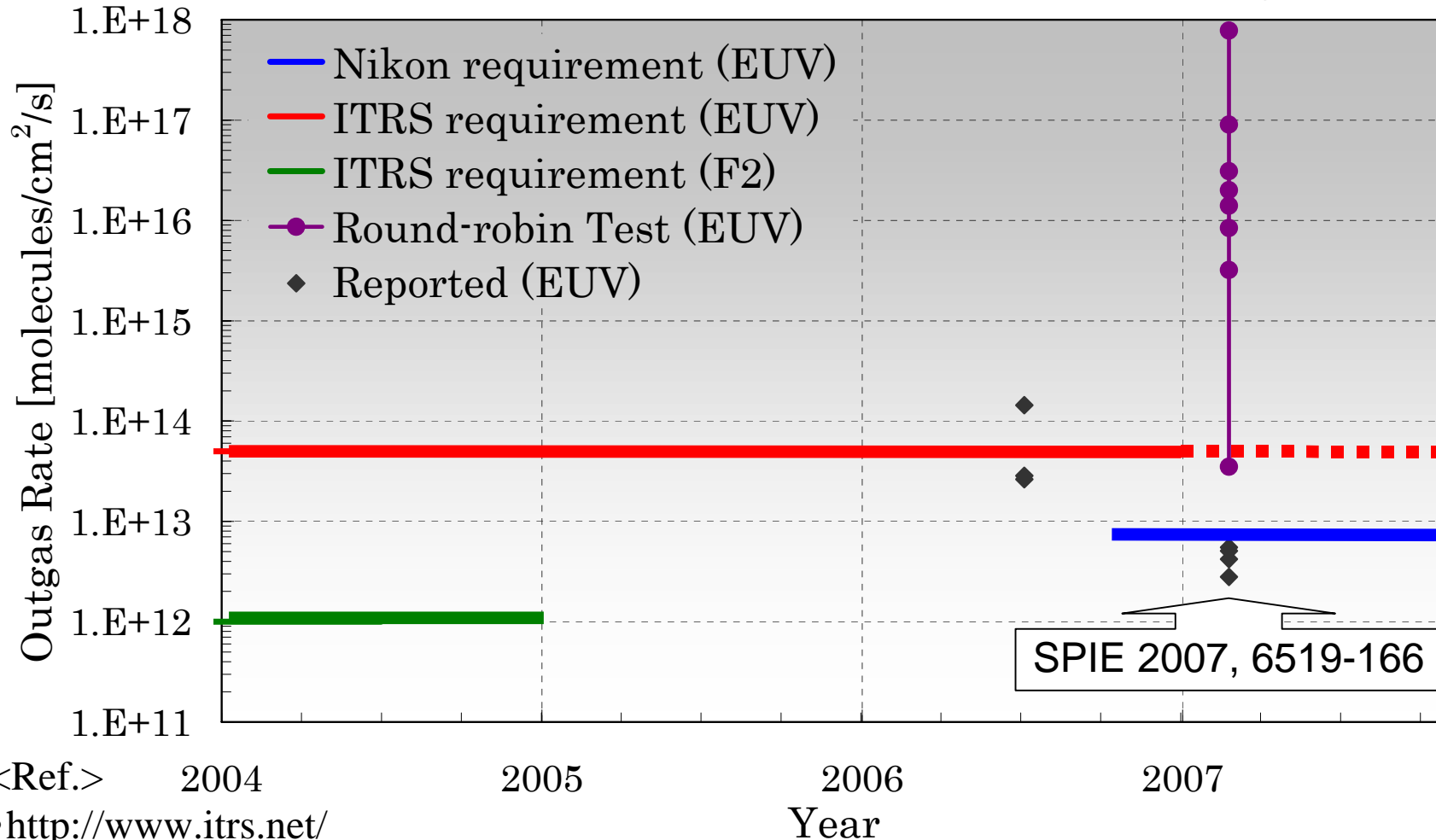
Degree of Vacuum of PO  $1 \times 10^{-5}$  Pa for H<sub>2</sub>O  
 $1 \times 10^{-7}$  Pa for C<sub>x</sub>H<sub>y</sub>

## Acceptable Level

	Outgassing Rate [molecules cm <sup>-2</sup> s <sup>-1</sup> ]
H <sub>2</sub> O	$7 \times 10^{14}$
C <sub>x</sub> H <sub>y</sub> (>44 amu)	$7 \times 10^{12}$

# History of Resist Outgassing Rate

## Photoresist Outgassing Rate History



<Ref.>

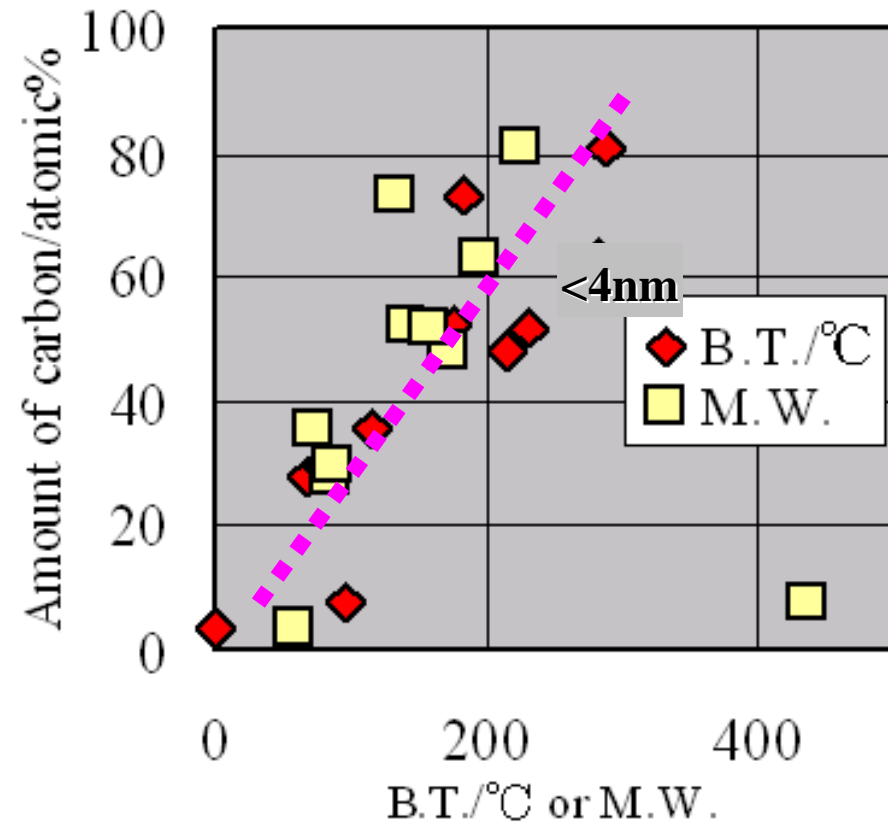
- <http://www.itrs.net/>
- SPIE Proceedings, 2000~2007
- EUVL Symposium, 2002~2007
- NGL Workshop, 2002~2007

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

# Acceptable Outgassing Rate

Presented at EUV Sympo., Barcelona

Organic gas	B.T./°C	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

- Nikon's requirement of resist outgassing rate for EUV1 is  $7E12$  molecules  $\text{cm}^{-2} \text{s}^{-1}$  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.