

EUVL Mask and Chuck Standards Workshop

Reticle Chuck Specifications

- **SEMI Draft 3419 – Table 2 calls for reticle chuck clamp pressure of 15 ± 0.1 kPa.**
 - **Earlier work from ASML (July 2001 workshop) uses $15 \text{ kPa} \pm 10\%$ in an example.**
 - **Nikon regards a uniformity of ± 0.1 kPa as difficult and would like to understand its origin. A $\pm 10\%$ spec would be preferable, if it doesn't affect the chuck performance.**
 - **Has any modeling been done to support either number?**
- **SEMI Draft 3419 – Table 1: some of the numbers appear to be incorrect**

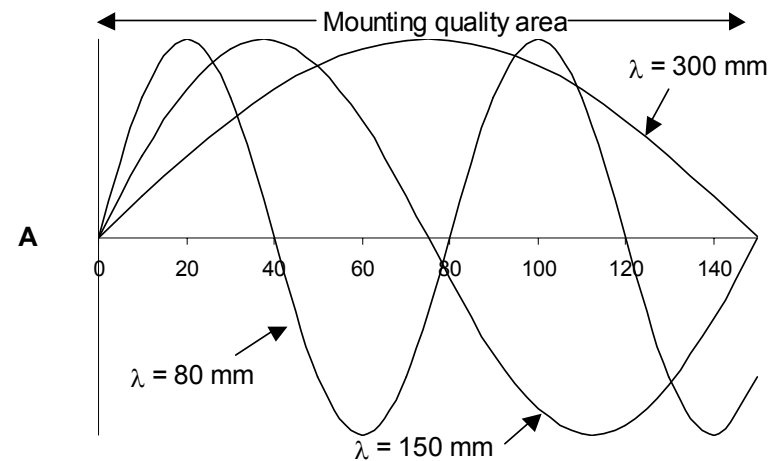
Overlay errors due to reticle clamping

- Numeric case:
 - Clamping pressure standardized at 0.15 Bar +/- 10% for both litho and writer tool.
 - Clamp surface flatness standardized at local tilts $\varphi < 1 \mu\text{rad}$ for areas larger than 10 x 10 mm. This is comparable to the following challenging flatness specification.

40 nm	150 x 150 mm (spatial frequency = 0.5)
24 nm	75 x 75 mm (spatial frequency = 1)
12 nm	40 x 40 mm (spatial frequency = 2)
7 nm	25 x 25 mm (spatial frequency = 3)
5 nm	20 x 20 mm (spatial frequency = 4)
4 nm	15 x 15 mm (spatial frequency = 5)
3 nm	12 x 12 mm (spatial frequency = 6)
2.5 nm	10 x 10 mm (spatial frequency = 7)

Clamp surface flatness spec – SEMI 3419 – Table 1

- The flatness spec appears to come from the ASML July 2001 workshop presentation.
- Flatness is defined by requirement that local tilts of surface be $< 1 \mu\text{rad}$.
- Surface profile: $y(x) = A \sin(2\pi x/\lambda)$.
- Local tilt: $y'(x) = A(2\pi/\lambda)\cos(2\pi x/\lambda)$.
- Maximum local tilt: $y'_{\text{max}} = A(2\pi/\lambda) \rightarrow A(2\pi/\lambda) < 10^{-6}$
so $A < (\lambda/2\pi) 10^{-6}$
- Determine allowable peak-to-valley flatness from this relation.



Clamp surface flatness spec – SEMI 3419 – Table 1

Table 1 Flatness of the mounting surface

Any square region with specified edge length (millimeters) Peak-to-valley flatness (nanometers)

150	40
75	24
40	12
25	7
20	5
15	4
12	3
10	2.5

Square region with specified edge length (mm)	λ (mm)	Peak to valley flatness (nm)
150	300	47.7
75	150	23.9
40	80	12.0
25	50	8.0
20	40	6.1
15	30	4.8
12	24	3.9
10	20	3.2