

The ASML logo is rendered in a bold, dark blue, sans-serif font. The background of the slide features a light blue gradient with abstract, flowing white and light blue lines that create a sense of motion and depth.

## Pellicle HVM specifications

Derk Brouns

Pellicle TWG 2016, San Jose CA

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# Preliminary EUV pellicle requirements

## Specifications shown at SPIE Advanced Lithography, 2014

**ASML**

Public  
Slide 2  
21-2-2016

	Item	Requirement
<b>Pellicle material requirements</b>	Pellicle film EUV transmission	90% single pass (81% double pass)
	EUV transmission spatial non-uniformity	< 0.2%
	EUV transmission angular non-uniformity	< 300 mrad max. local pellicle angle
	EUV intensity in scanning slit @ pellicle	5 W/cm <sup>2</sup> (250W EUV source equivalent)
	Lifetime	~315 hrs (production hours in a EUV+H <sub>2</sub> environment)
<b>Pellicle + frame requirements</b>	Standoff distance during exposure	2 ± 0.5 mm
	Max. acceleration	100 m/s <sup>2</sup> during scanning
	Max. ambient pressure rate of change	< 3.5 mbar/s (peak during pump-down/ vent in the load lock)
	Reticle reserved area for pellicle assembly (centered on substrate)	110.7 mm x 144.1 mm: inner 118.0 mm x 150.7 mm: outer

# Preliminary EUV pellicle requirements

## Update on 2014 specifications

**ASML**

Public  
Slide 3  
21-2-2016

	Item	Requirement
<b>Pellicle material requirements</b>	Pellicle film EUV transmission	90% single pass (81% double pass)
	<b>EUV transmission spatial non-uniformity</b>	<b><math>\leq 0.2\%</math> <math>0.4\%</math> Half Range</b>
	EUV transmission angular non-uniformity	$< 300$ mrad max. local pellicle angle
	EUV intensity in scanning slit @ pellicle	5 W/cm <sup>2</sup> (250W EUV source equivalent)
	Lifetime	~315 hrs (production hours in a EUV+H <sub>2</sub> environment)
<b>Pellicle + frame requirements</b>	Standoff distance during exposure	2 ± 0.5 mm
	Max. acceleration	100 m/s <sup>2</sup> during scanning
	Max. ambient pressure rate of change	$< 3.5$ mbar/s (peak during pump-down/ vent in the load lock)
	Reticle reserved area for pellicle assembly (centered on substrate)	110.7 mm x 144.1 mm: inner 118.0 mm x 150.7 mm: outer



# Preliminary EUV pellicle requirements

## Update on 2014 specifications

**ASML**

Public  
Slide 4  
21-2-2016

	Item	Requirement
<b>Pellicle material requirements</b>	Pellicle film EUV transmission	90% single pass (81% double pass)
	EUV transmission spatial non-uniformity	<del>&lt;0.2%</del> 0.4% Half Range
	EUV transmission angular non-uniformity	< 300 mrad max. local pellicle angle
	EUV intensity in scanning slit @ pellicle	5 W/cm <sup>2</sup> (250W EUV source equivalent)
<b>Pellicle + frame requirements</b>	<b>Standoff distance during exposure</b>	<del>2 ± 0.5 mm</del> <b>2.5 mm</b>
	Max. acceleration	100 m/s <sup>2</sup> during scanning
	Max. ambient pressure rate of change	< 3.5 mbar/s (peak during pump-down/ vent in the load lock)
	Reticle reserved area for pellicle assembly (centered on substrate)	110.7 mm x 144.1 mm: inner 118.0 mm x 150.7 mm: outer



# Preliminary EUV pellicle requirements

## Update on 2014 specifications

**ASML**

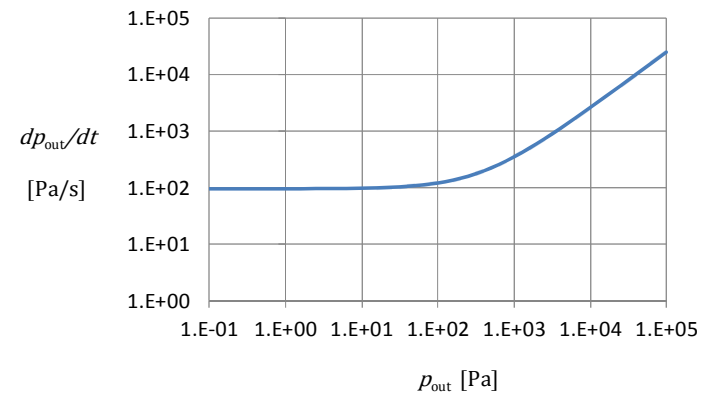
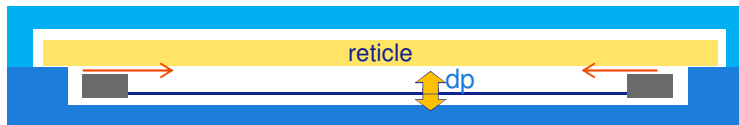
Public  
Slide 5  
21-2-2016

	Item	Requirement
<b>Pellicle material requirements</b>	Pellicle film EUV transmission	90% single pass (81% double pass)
	EUV transmission spatial non-uniformity	<del>&lt;0.2%</del> 0.4% Half Range
	EUV transmission angular non-uniformity	< 300 mrad max. local pellicle angle
	EUV intensity in scanning slit @ pellicle	5 W/cm <sup>2</sup> (250W EUV source equivalent)
	Lifetime	~315 hrs (production hours in a EUV+H <sub>2</sub> environment)
<b>Pellicle + frame requirements</b>	Standoff distance during exposure	<del>2 ± 0.5 mm</del> 2.5 mm
	Max. acceleration	100 m/s <sup>2</sup> during scanning
	<b>Max. ambient pressure rate of change</b>	<del>&lt; 3.5 mbar/s (peak during pump-down/vent in the load lock) see next slide</del>
	Reticle reserved area for pellicle assembly (centered on substrate)	110.7 mm x 144.1 mm: inner 118.0 mm x 150.7 mm: outer



## Max. ambient pressure rate of change

- While in the load lock, the gas in the pellicle volume needs to be removed (pump down) or filled (vent).
- The gas needs to pass the micro gap between the reticle and the pellicle frame, creating a flow resistance.
- This flow resistance creates a pressure differential over the film, which may not deflect more than 0.5 mm over the full cycle.
- For the NXE pellicle, ASML has modified the load lock curve to limit the differential pressure over the film to  $< 2$  Pa. At this differential pressure, the film may not deflect more than 0.5 mm



# Preliminary EUV pellicle requirements

## Specifications shown at SPIE Advanced Lithography, 2014

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Public  
Slide 7  
21-2-2016

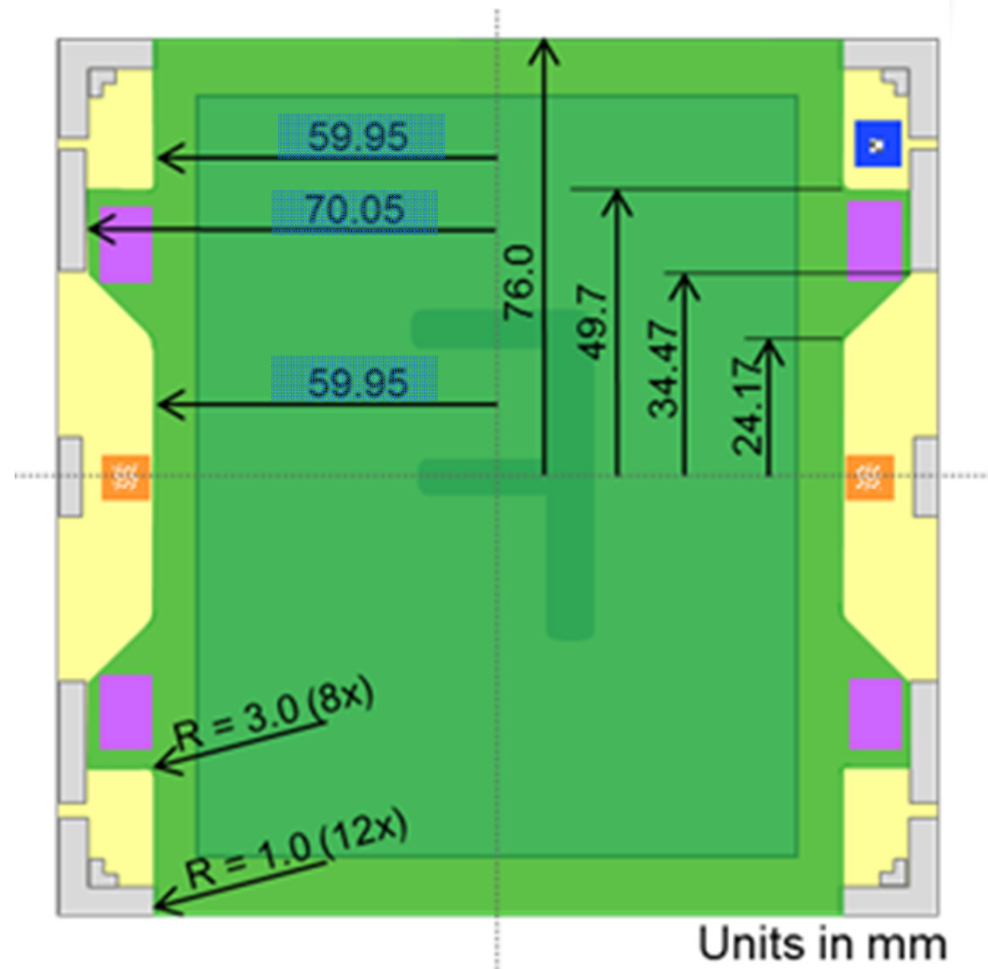
	Item	Requirement
<b>Pellicle material requirements</b>	Pellicle film EUV transmission	90% single pass (81% double pass)
	EUV transmission spatial non-uniformity	<del>&lt;0.2%</del> 0.4% Half Range
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<b>Pellicle + frame requirements</b>	Standoff distance during exposure	<del>2 ± 0.5 mm</del> 2.5 mm
	Max. acceleration	100 m/s <sup>2</sup> during scanning
	Max. ambient pressure rate of change	<del>&lt; 3.5 mbar/s (peak during pump-down/ vent in the load lock)</del> See next slide
	<b>Reticle reserved area for pellicle assembly (centered on substrate)</b>	<del>110.7 mm x 144.1 mm: inner</del> <del>118.0 mm x 150.7 mm: outer</del> See next slide



# NXE pellicle reserved area

Area for pellicle on the reticle

Note: highlighted values are updated compared to RDM V11



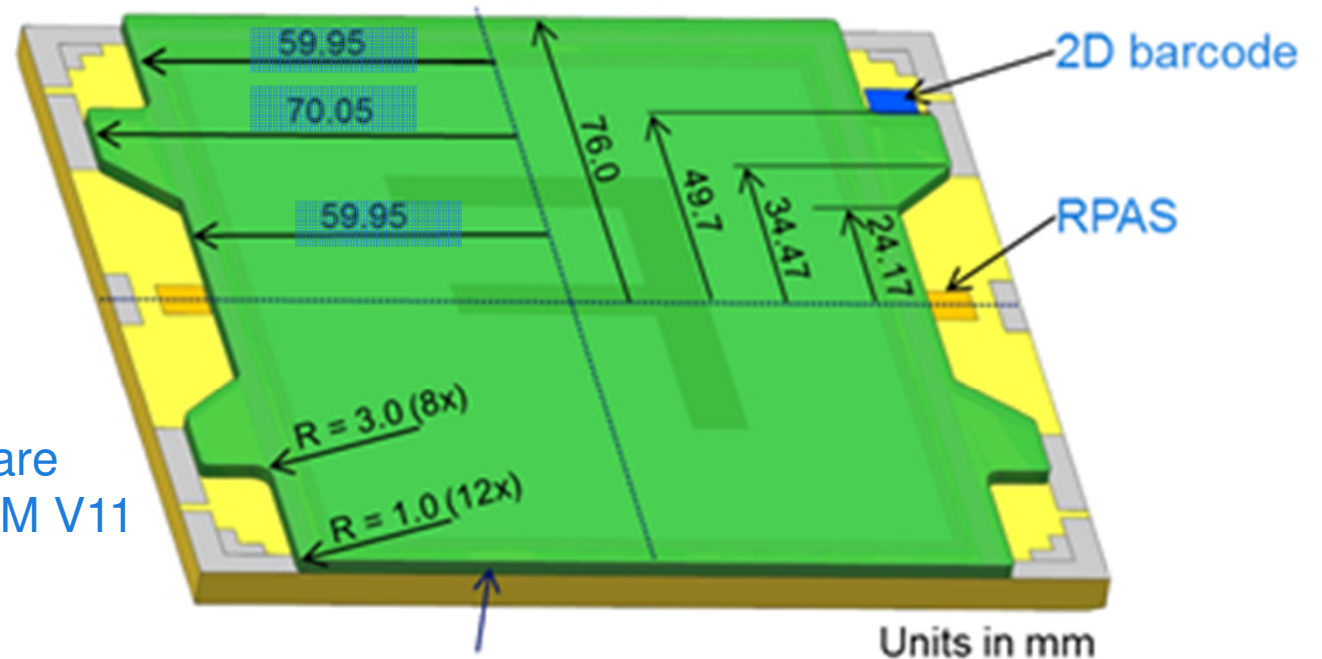


# NXE pellicle volume claim

Pellicle reserved volume (irt external tooling)

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Note: highlighted values are updated compared to RDM V11

Pellicle volume height from reticle surface < 2.7mm

# NXE pellicle stud reserved area

Areas reserved for studs

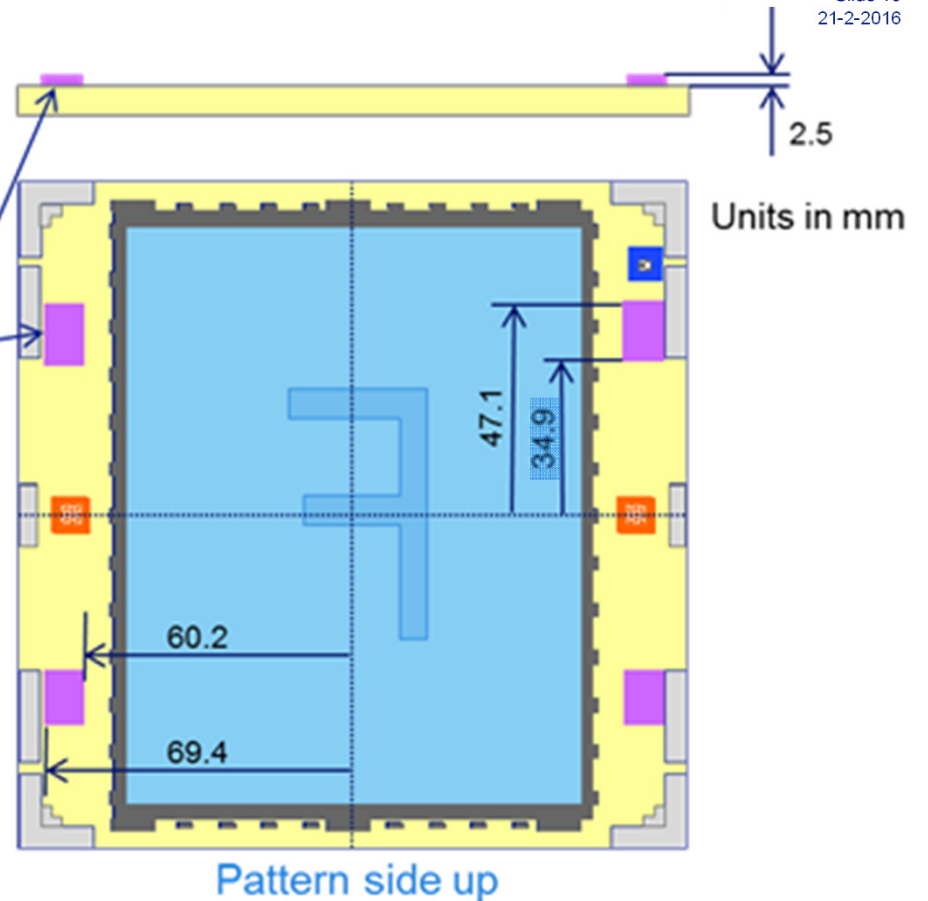
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Slide 10  
21-2-2016

Frame mount reserved volume (4)  
9.2mm x 12.2mm x 2.5mm

Mounting hardware is located in  
these 4 volumes

Note: highlighted values are  
updated compared to RDM V11



# Preliminary EUV pellicle requirements for HVM insertion

## Update 2016: summary

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Public  
Slide 11  
21-2-2016

	Item	Requirement
<b>Pellicle material requirements</b>	Pellicle film EUV transmission	90% single pass (81% double pass) Product pellicle release transmission: >88% single pass
	EUV transmission spatial non-uniformity	< 0.4% Half range
	EUV transmission angular non-uniformity	< 300 mrad max. local pellicle angle
	EUV intensity in scanning slit @ pellicle	5 W/cm <sup>2</sup> (250W EUV source equivalent)
	Lifetime	under investigation
<b>Pellicle + frame requirements</b>	Standoff distance during exposure	2.5 mm
	Max. acceleration	100 m/s <sup>2</sup> during scanning
	Max. ambient pressure rate of change	Pressure gradient according to LDLK curve Film: deflection at 2Pa dP < 0.5 mm
	Reticle reserved area for pellicle assembly (centered on substrate)	See drawings

## Update 2016: summary

- Pellicles will continued to be tested inside and outside of the NXE Scanner. This new learning will enable more accurate target setting for pellicles
- A more elaborate update on the requirements is expected at BACUS2016

	Item	Requirement
<b>Pellicle material requirements</b>	Pellicle film EUV transmission	90% single pass (81% double pass) Product pellicle release transmission: >88% single pass
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<b>Pellicle + frame requirements</b>	Standoff distance during exposure	2.5 mm
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	Max. ambient pressure rate of change	Pressure gradient according to LDLK curve Film: deflection at 2Pa dP < 0.5 mm
	Reticle reserved area for pellicle assembly (centered on substrate)	See drawings

The image features the ASML logo in a bold, dark blue, sans-serif font. The logo is positioned on the left side of a light blue background. The background is composed of several overlapping, curved, semi-transparent shapes that create a sense of depth and movement. On the right side, there are several thin, white, wavy lines that flow from the center towards the right edge, adding a dynamic and futuristic feel to the overall design.

**ASML**