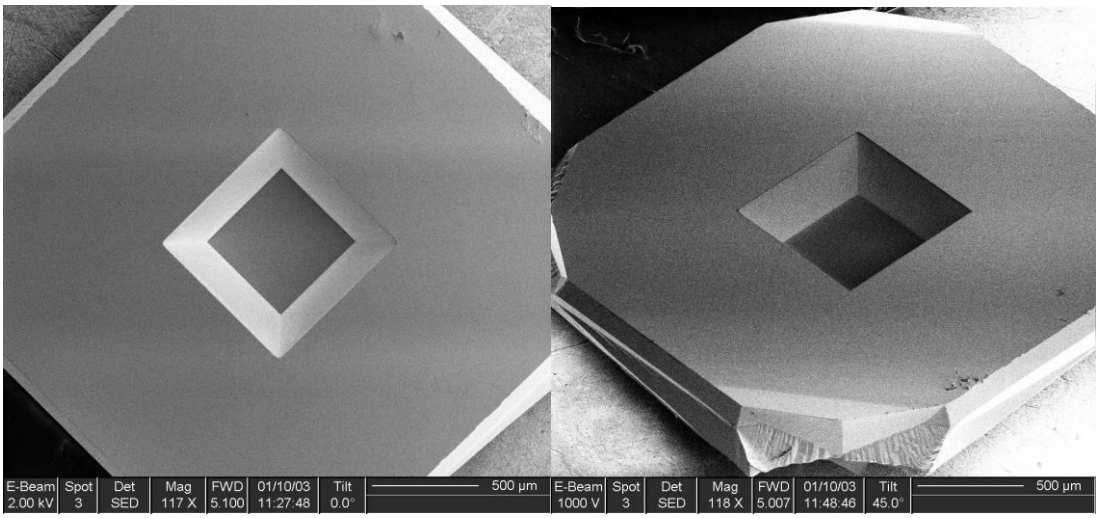
Technical Support Bulletin

EM-Tec Silicon Nitride Support Films Details



Products
This Technical Support Bulletin covers all silicon nitride support film products #23-201001 through #23-120125

Silicon nitride support films production
The EM-Tec generation silicon nitride support films are produced using state-of-the-art MEMS manufacturing techniques. The silicon nitride films with 10nm, 20nm, 30nm, 50nm, 100nm and 200nm thickness are grown on a 200µm or 100 µm thick ultra-flat P-type, boron doped, silicon wafer with a resistivity of 5-15ohm/cm. The formulation of the silicon nitride film is non-stochiometric silicon rich Si3N4 and is adjusted to the desired properties and optimised stress level needed for extra flat support films. This results in Silicon rich membranes with a thickness over 20nm. The windows are etched away in the silicon substrate leaving a robust, freestanding silicon nitride membrane. The membranes are not supported in the window area, leaving a large unrestricted viewing area.

3mm TEM grid holder compatible frames
The silicon frames are processed into a 2.65 x 2.65 die with the corners back-etched to make them fit into the standard 3.05mm TEM grid holders.
The frames with a thickness of 200µm are fully compatible with most TEM sample holders. For special TEM grid holders which require thinner frames; the silicon nitride membranes are available on a 100 µm thin silicon frame.

Clean support films
The manufacturing and cleaning processes and subsequent clean room handling, including packaging, provide a clean silicon support film.

Window sizes
The etching process and the crystal structure of the silicon wafer result in an etching angle of 35°. This leaves a larger opening on the backside of the wafer. It makes it very easy to determine the top side with the silicon nitride support film.

Micro to Nano
Tappersweg 91
2031ET Haarlem
The Netherlands

T +31-85-2013155
E info@microtonano.com
W www.microtonano.com
Kvk AMS: # 62301959

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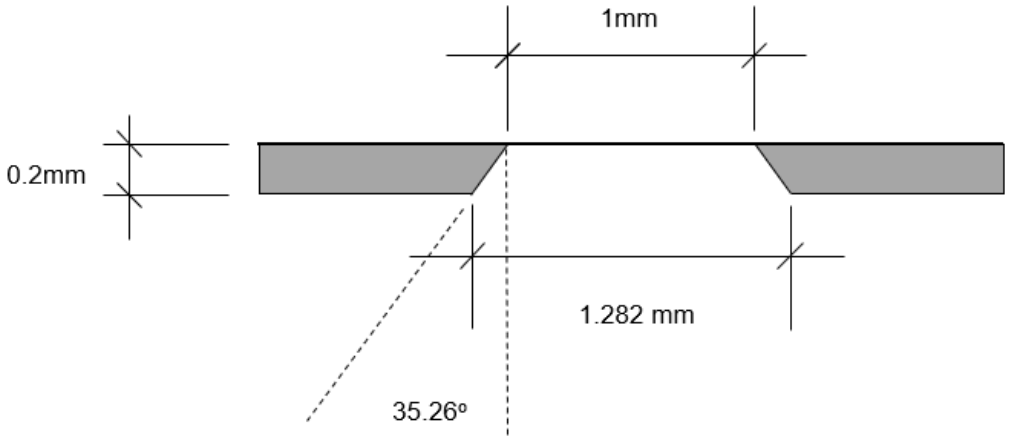

Example of
1.0 x 1.0mm window
on 200 µm substrate

Window sizes top view and backside:

Window X	Window Y	Area	Backside X	Backside Y	Support films	Frame T
0.10mm	0.10mm	0.01mm2	0.38mm	0.38mm	10/20/30/50/100/200nm	200/100µm
0.25mm	0.25mm	0.06mm2	0.53mm	0.53mm	10/20/30/50/100/200nm	200/100µm
0.50mm	0.50mm	0.25mm2	0.78mm	0.78mm	10/20/30/50/100/200nm	200/100µm
1.00mm	1.00mm	1.00mm2	1.28mm	1.28mm	20/30/50/100/200nm	200/100µm
1.00mm	0.25mm	0.25mm2	1.28mm	0.53mm	20/30/50/100/200nm	200/100µm

Product tolerances

The EM-Tec silicon nitride support films consist of a 2.65 x2.65 mm square silicon frame with back-etched corners and a silicon nitride membrane. As with all manufacturing techniques, there can be small variations from batch to batch. The tight product tolerances are:

Parameter	**Product tolerances**
Membrane thickness	10nm ±2nm 20nm ±3nm 30nm ±3nm 50nm ±4nm 100nm ±5nm 200nm ±10nm
Window dimensions	0.10 x 0.10mm - 100µm ±5µm 0.25 x 0.25mm - 250µm ±10µm 0.50 x 0.50mm - 500µm ±20µm 1.00 x 1.00mm - 1000µm ±30µm 1.00 x 0.25mm - 1000µm ±30µm / 250µm ±10µm
Frame thickness	200µm ±15µm 100µm ±8µm
Frame diameter compatibility	3.0mm ±0.05nm

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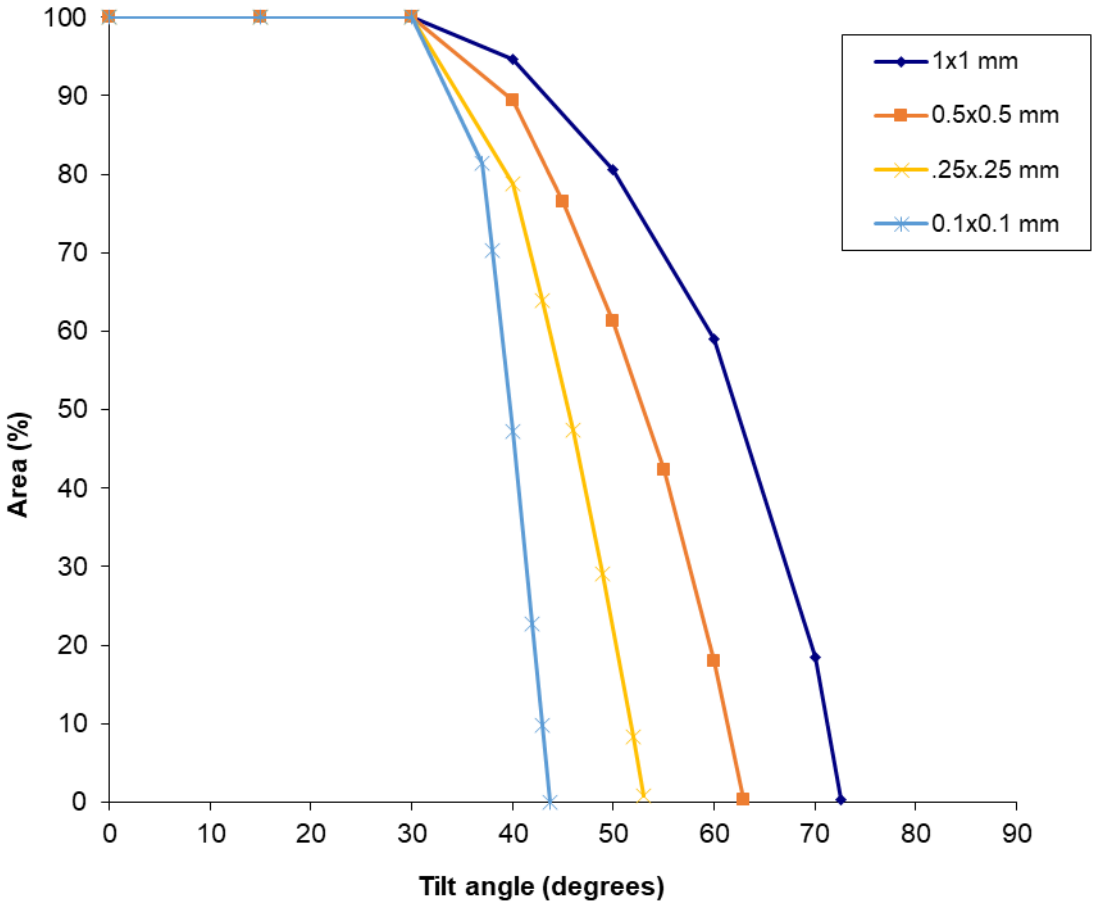
Tilt angle limitations

The etching angle at the window sides is 35°, which means that the silicon nitride support films can be tilted to 35° for full area imaging. For tilting angles higher than 35°, the sample needs to be in the center of the window. The highest possible tilting angle with the 200µm thick frames can be achieved with the 1 x 1 mm windows. They allow for a maximum tilting angle of 73°. The imaging area at 70° tilting angle reduces to 10% of the 1 x 1 mm window.



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W www.microtonano.com
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