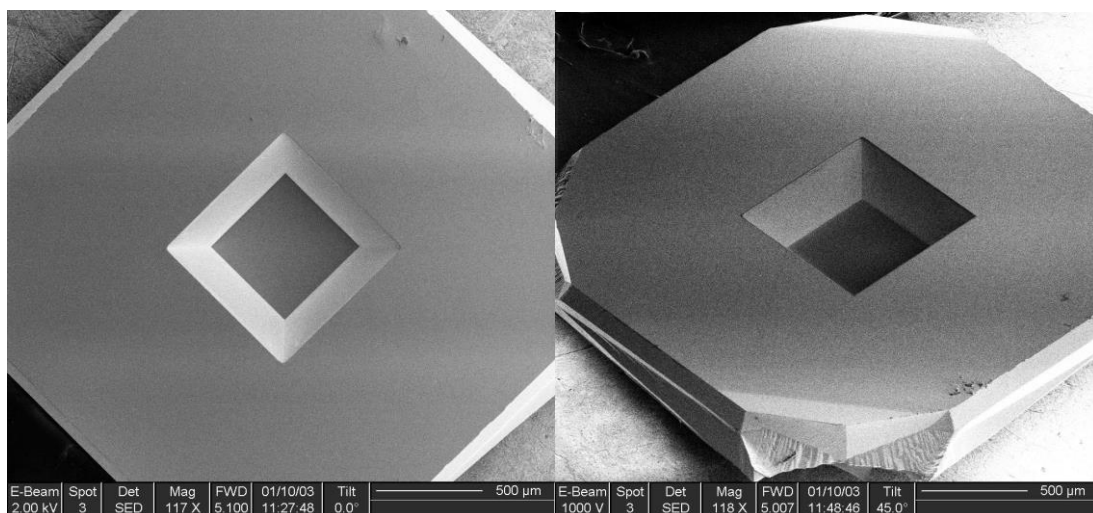


## EM-Tec Silicon Nitride Support Films Details



### 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-stoichiometric silicon rich Si<sub>3</sub>N<sub>4</sub> 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.

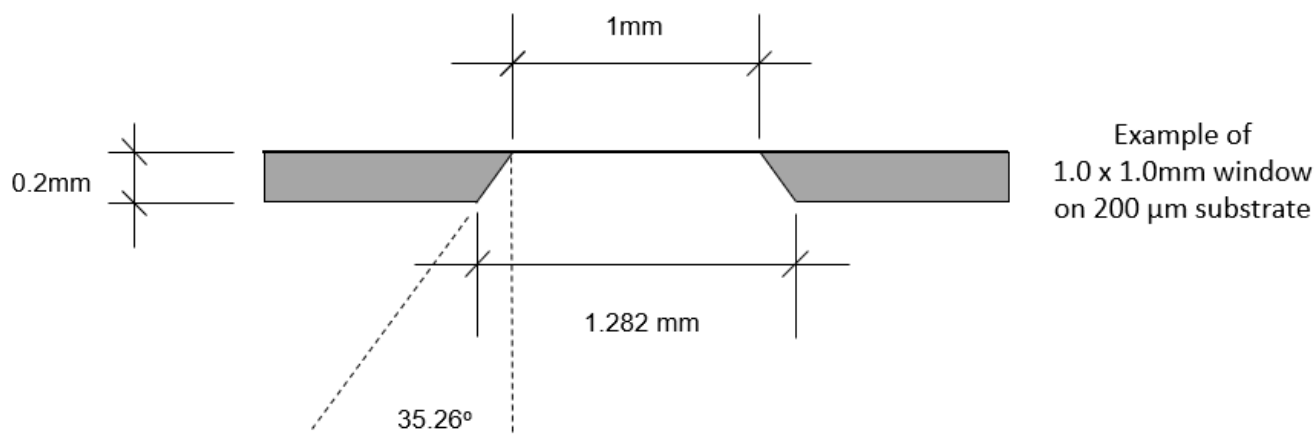
The frames with a thickness of 200µm are fully compatible with most TEM sample holders. For special TEM grid holders which require thinner frames; the silicon nitride membranes are available on a 100 µm thin silicon frame.

### 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.



## Window sizes top view and backside:

Window X	Window Y	Area	Backside X	Backside Y	Support films	Frame T
0.10mm	0.10mm	0.01mm <sup>2</sup>	0.38mm	0.38mm	10/20/30/50/100/200nm	200/100µm
0.25mm	0.25mm	0.06mm <sup>2</sup>	0.53mm	0.53mm	10/20/30/50/100/200nm	200/100µm
0.50mm	0.50mm	0.25mm <sup>2</sup>	0.78mm	0.78mm	10/20/30/50/100/200nm	200/100µm
1.00mm	1.00mm	1.00mm <sup>2</sup>	1.28mm	1.28mm	20/30/50/100/200nm	200/100µm
1.00mm	0.25mm	0.25mm <sup>2</sup>	1.28mm	0.53mm	20/30/50/100/200nm	200/100µm

## Product tolerances

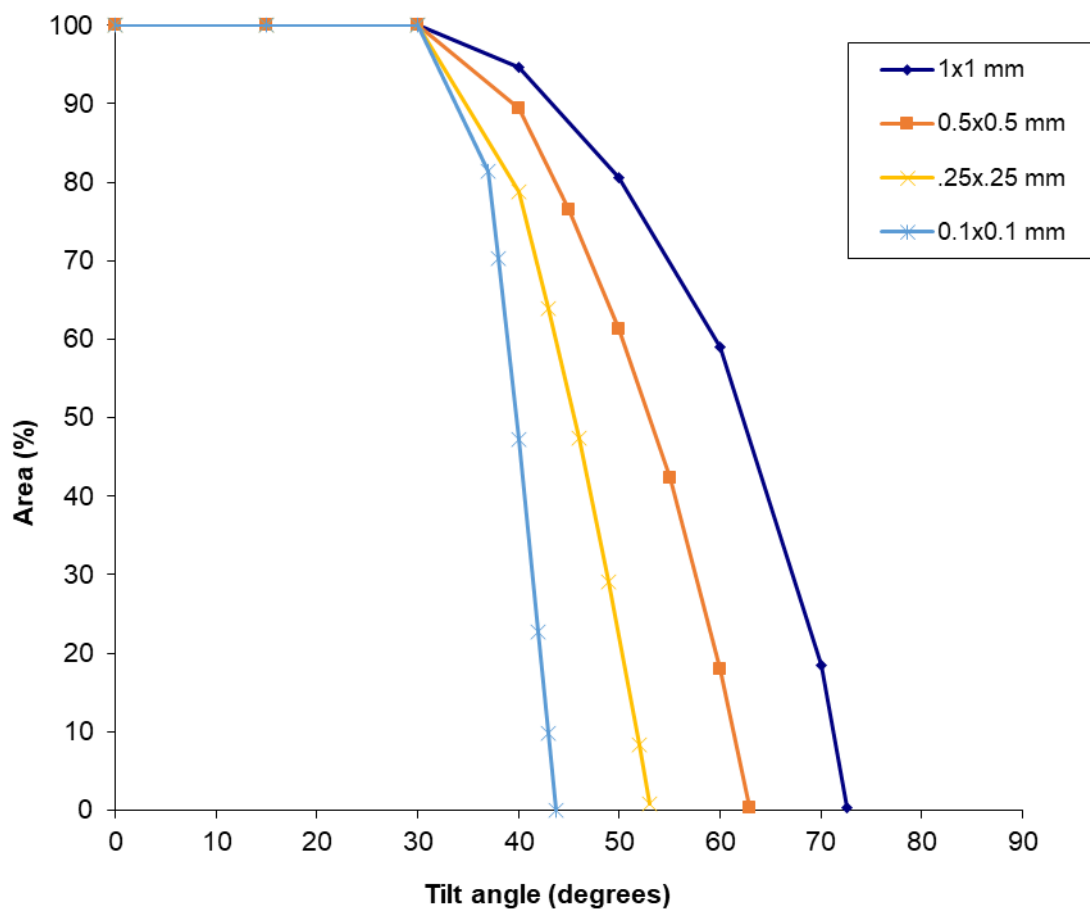
The EM-Tec silicon nitride support films consist of a 2.65 x 2.65 mm square silicon frame with back-etched corners and a silicon nitride membrane. As with all manufacturing techniques, there can be small variations from batch to batch. The tight product tolerances are:

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 ±0.05mm



## 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.



TSB 23-201001 EM-Tec silicon nitride support films details 2018-05-06 Revision 2

