28 June 2016

Miling of Chromium coated SiN membrane.

12:00

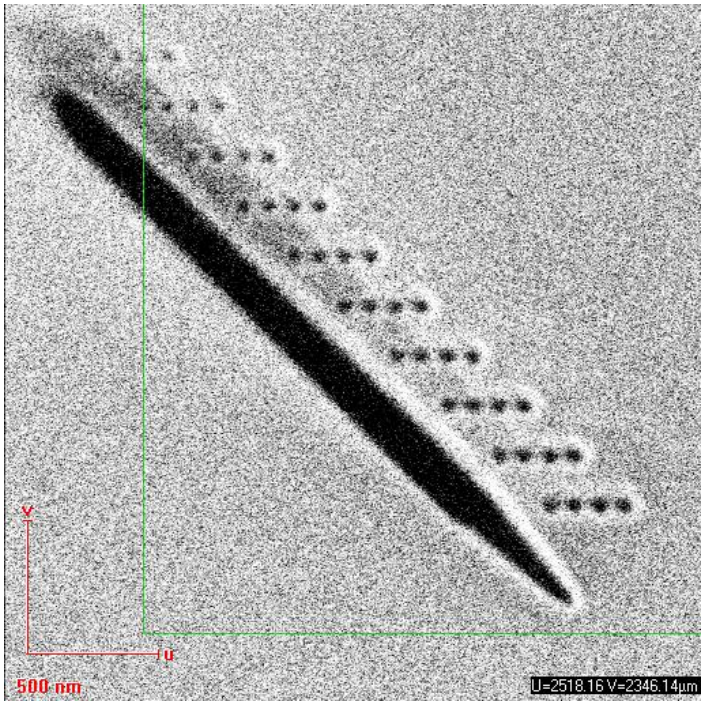
Parameters :

Coating	5 nm Cr
Thickness	5 + 100 nm
Beam	10µm – 1pA (6)
Area Dose	20000 µC/cm²
Loop factor	1
Dot dose	2.0088 pC
Dot dwell time	2287.93 ms
Design	*Fp-triangle2*
Design Dose factor	*1*

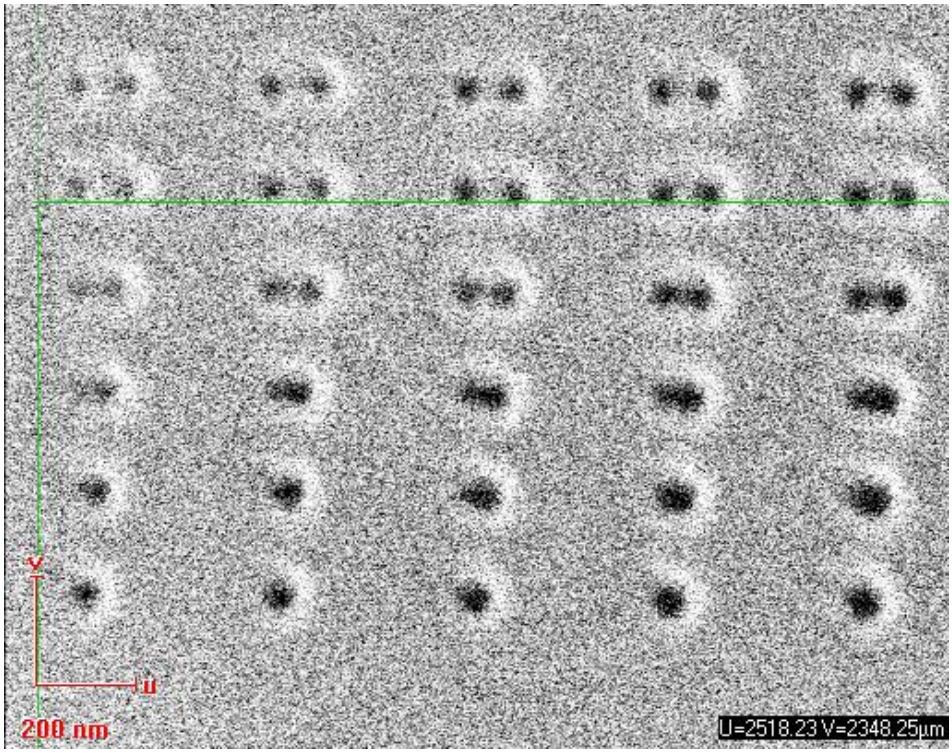
Notes :

On the design points are now on top of triangle
Area step size 0.0032
i=0.878pA

Results :



The triangle is not well-milled because there is only one loop. It pierces through the membrane anyway. But it is hard to tell if the dots pierced through it.



Point of dose factor 0.6 to 1.4, separated by (up to bottom) 100, 80,60,40,20 and 10 nm

We can distinguish points separated by ~50 nm. The minimal diameter of a point we achieve is **50nm**.

We now try the same experience with loops. We set the dot dose to 0.10044 to have the same total dose (2.0088 pC)

13:00 – 14:00

Parameters :

Coating	5 nm Cr
Thickness	5 + 100 nm
Beam	10µm – 1pA (6)
Measured current	
Area Dose	1000 µC/cm²
Area step size	0.0032
Area dwell time	0.109989 ms
Loop factor	20
Dot dose	0.10044 pC
Dot dwell time	107.883995 ms
Design	*Fp-triangle2*
Design Dose factor	*1*

Results :

We obtained a huge astigmatism… We try the same experiment with better settings.

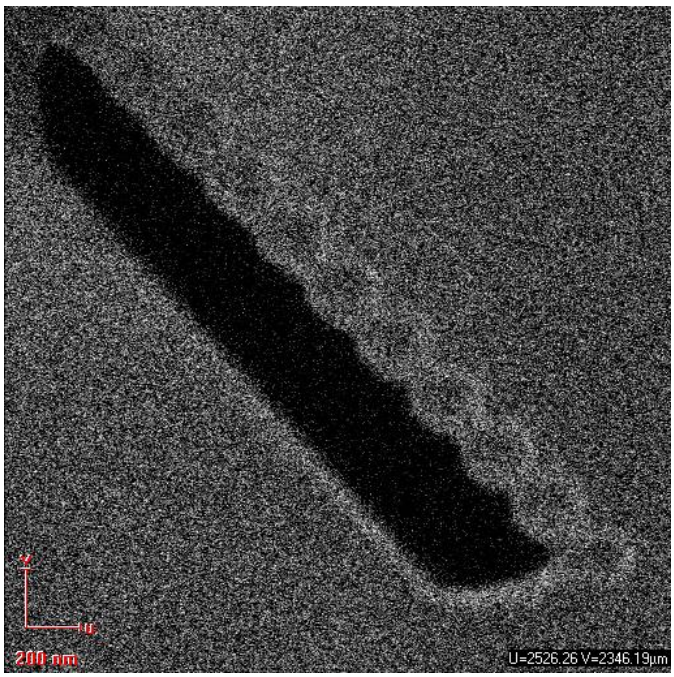
14:30 – 16:30

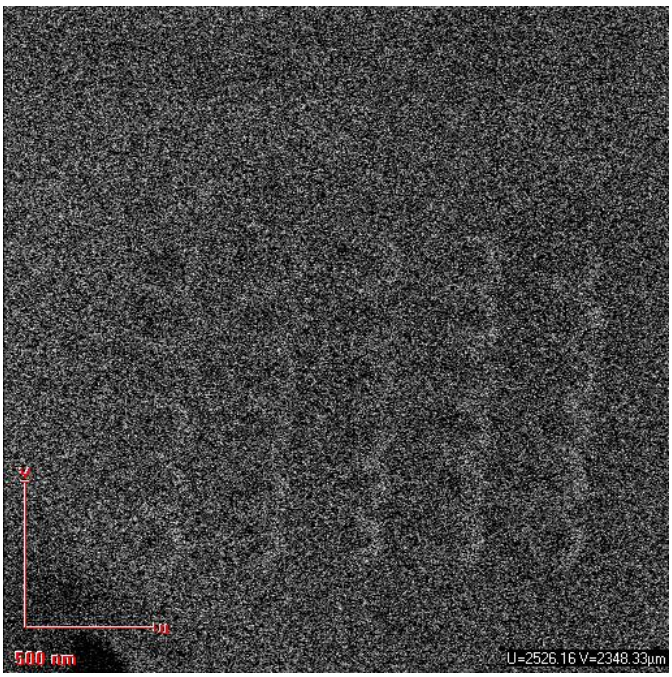
Parameters :

Coating	5 nm Cr
Thickness	5 + 100 nm
Beam	10µm – 1pA (6)
Measured current	**0.26 pA**
Area Dose	1000 µC/cm²
Loop factor	20
Dot dose	0.10044 pC
Design	*Fp-triangle2*
Design Dose factor	*1*

Results :

We tried the same parameter as before after setting the aperture and stigmatism better.
However we had very low current that's why dots didn't pierce the membrane.





Either the software does not provide 0.10044 pC each loop, even though we had a long dwell time to compensate the low current, or either the depth of the milling is not only linked to the dot dose, but also to the time of exposure.
It seems that long-time milling at low current is not as effective as short milling at higher current.
The triangle still pierces through the membrane.

16:45 – test of lines and dots

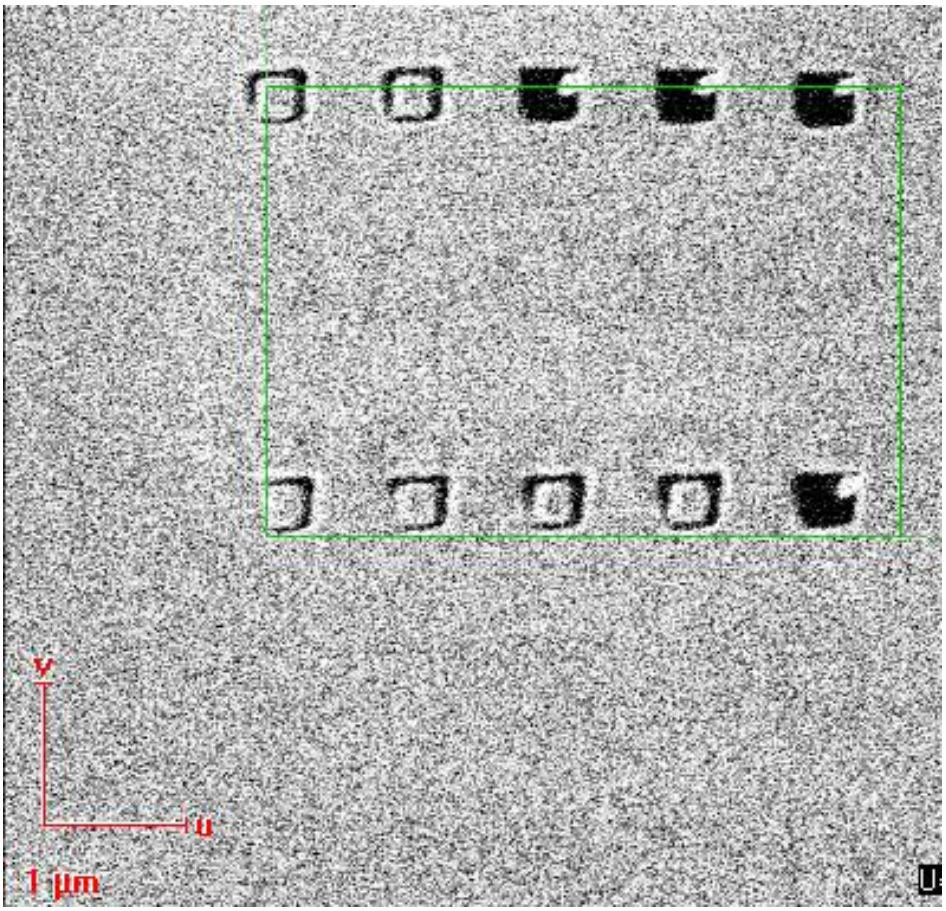
We try to make fall a part of the membrane by milling around it, with dots or with lines.

Parameters :

Coating	5 nm Cr
Thickness	5 + 100 nm
Beam	10µm – 1pA (6)
Measured current	**0.771pA**
Line Dose	20000 µC/cm²
Line dwell time	
Loop factor	**1**
Dot dose	2.0088 pC
Dot dwell time	
Design	*Multiple-fall*
Design Dose factor	*1*

Results :

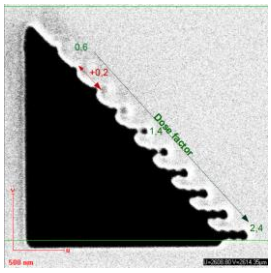
Two tests of Multiple falls for high (up) and low (bottom) line dose:



The design is composed of squares of lines and dots, of dose factor 1 to 1.8.
The lines barely mill through the membrane, while the dots mill through it for a dose factor 1.8. That is 1.8*2.0088pC=**3.62pC** (but it looks like it also goes through it for lower dose)

The bottom left corner is badly milled, that may be due to bad charge extraction. It is also possible that the milling of other corners affects the Chromium coating around, and makes it easier to mile through it after. We should look at the milling live to know which part is milled last.

This is unfortunate, because this design would spare us much time in testing if we –or don't- pierce through the membrane. As the previous one* we used requires a large area that takes up to 28minutes with 1pA:

* 

To know if we pierced through the membrane, there is another long method: we unload the sample and load it again, but upside down. Then we look for the place when we did our milling, and check if the hole was total.