View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by ScholarlyCommons@Penn

University of Pennsylvania
ScholarlyCommons

Protocols and Reports

Browse by Type

10-20-2017

Mask Flaw Propagation Using 360nm Long Pass Filter

Ram Surya Gona
University of Pennsylvania, ramgona@seas.upenn.edu

Eric D. Johnston
Singh Center for Nanotechnology, ericdj@seas.upenn.edu

Follow this and additional works at: http://repository.upenn.edu/scn_protocols

Gona, Ram Surya and Johnston, Eric D., "Mask Flaw Propagation Using 360nm Long Pass Filter", *Protocols and Reports*. Paper 43.
http://repository.upenn.edu/scn_protocols/43

This paper is posted at ScholarlyCommons. http://repository.upenn.edu/scn_protocols/43
For more information, please contact repository@pobox.upenn.edu.

Mask Flaw Propagation Using 360nm Long Pass Filter

Abstract
To test the flaw propagation to features of SU-8 resist in the presence of 360nm long pass (LP) filter during exposure.

Creative Commons License

This work is licensed under a Creative Commons Attribution-Share Alike 4.0 License.

This technical report is available at ScholarlyCommons: http://repository.upenn.edu/scn_protocols/43

Mask Flaw Propagation Using 360nm Long Pass Filter

Critical Factors

- The use of a 360nm long pass (LP) filter during exposure of SU-8 results in flaws in the features in comparison to exposure without a filter. These flaws are present both on the surface of the exposed SU-8 features as well as in the form of cracks which extend from the Si substrate to the surface of the features.
- The long pass filter significantly increases the contrast of flaws in film masks

Table of Contents

a. Goal
b. Results
c. Materials
d. Equipment
e. Protocol

Goal

To test the flaw propagation to features of SU-8 resist in the presence of 360nm long pass (LP) filter during exposure.

Results

Procedure	Result	Comments	Image
Exposure of the wafer with blank without LP filter	The features show no flaws	The optical and FIB images show no flaws	Fig: 2, 4, 6,8,10, 12, 14, 16, 18, 20
Exposure of the wafer with LP filter	The features show flaws on the surface and cracks	Optical images and FIB images confirm flaws on the surface as well as crack through the features	Fig: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19

**To get reliable results, optical images of the same areas on the wafer are compared before and after treatment*

Comparison of optical images

With LP filter	***Without LP filter***

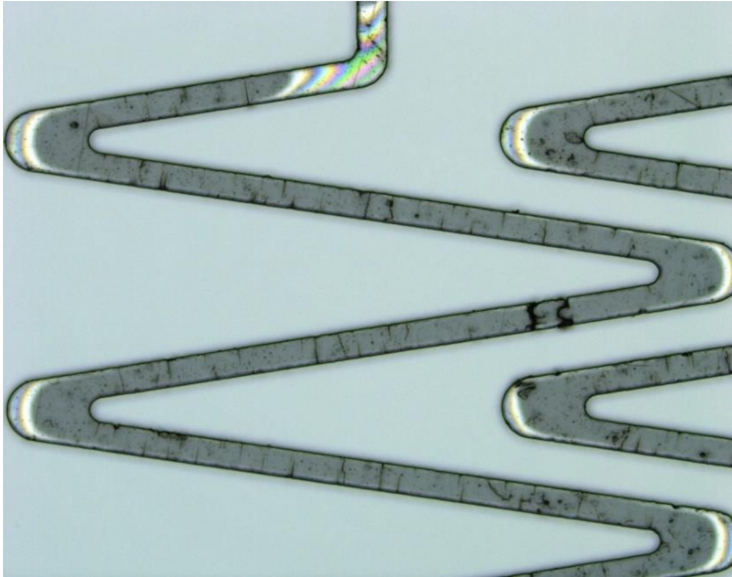

Figure 4 Flaws are evident on the surface of the features

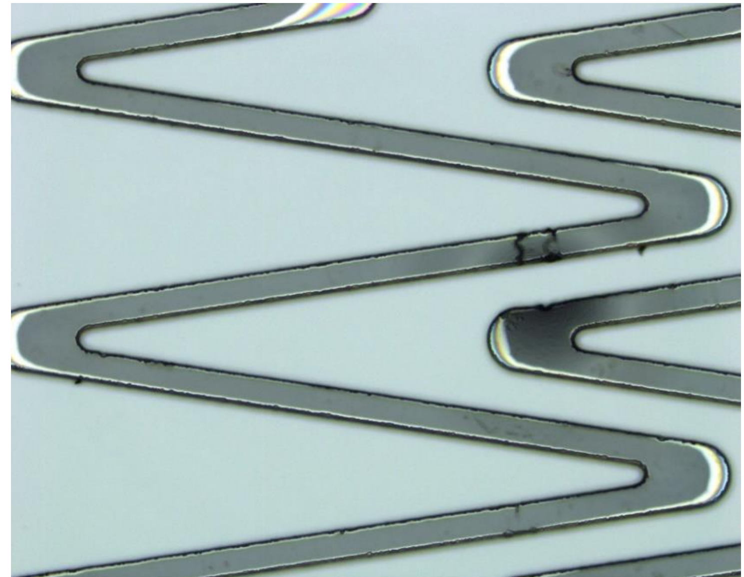

Figure 4 The surface is relatively smooth without any flaws

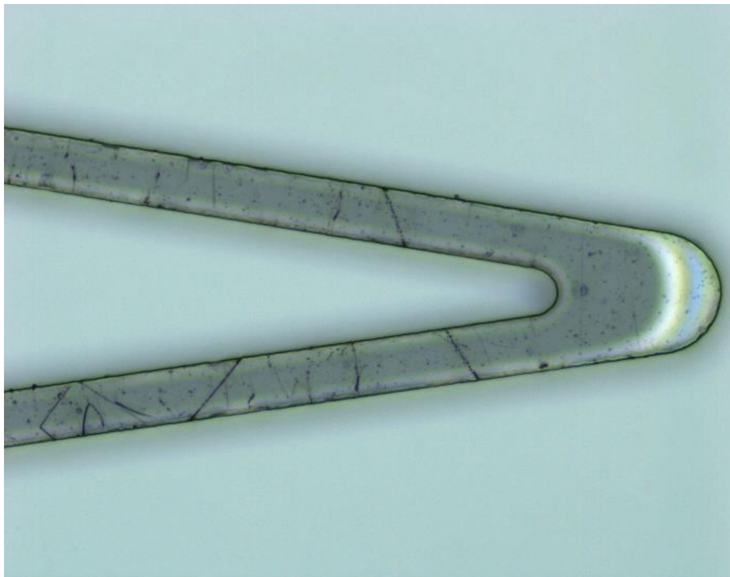

Figure 4 Flaws are evident on the surface of the features

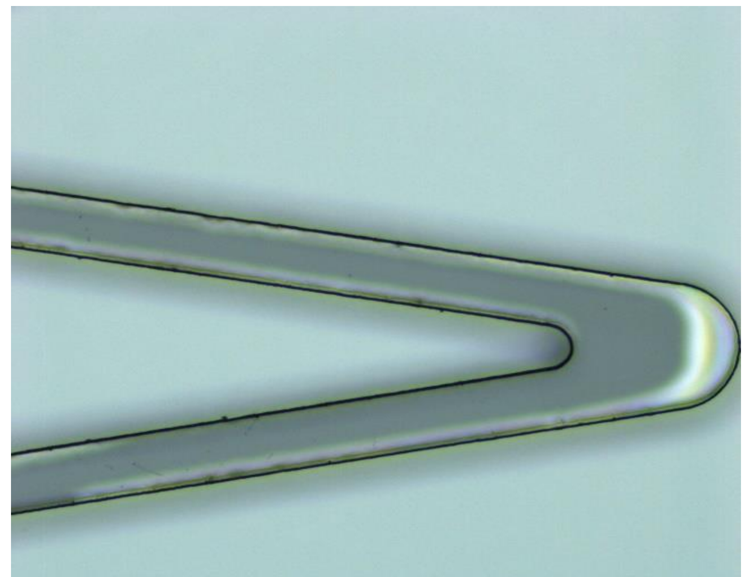

Figure 4 The surface is relatively smooth without any flaws

Comparison of optical images

With LP filter	*Without LP filter*

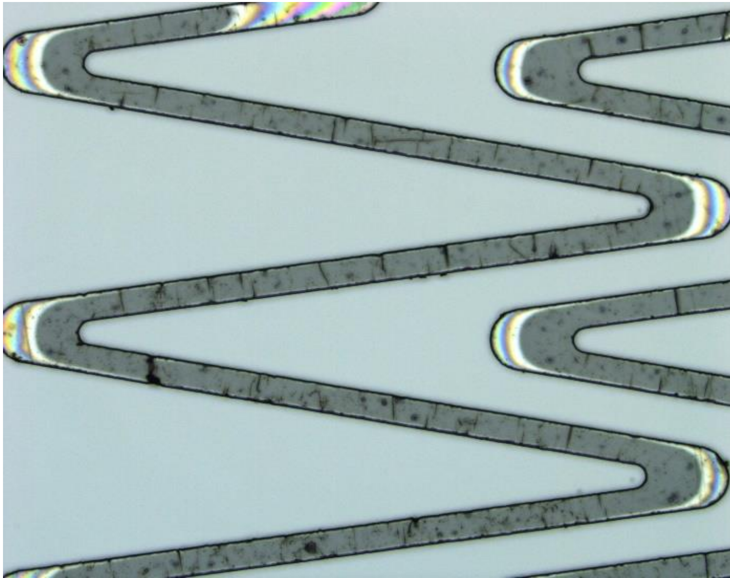

Figure 6 Flaws are evident on the surface of the features

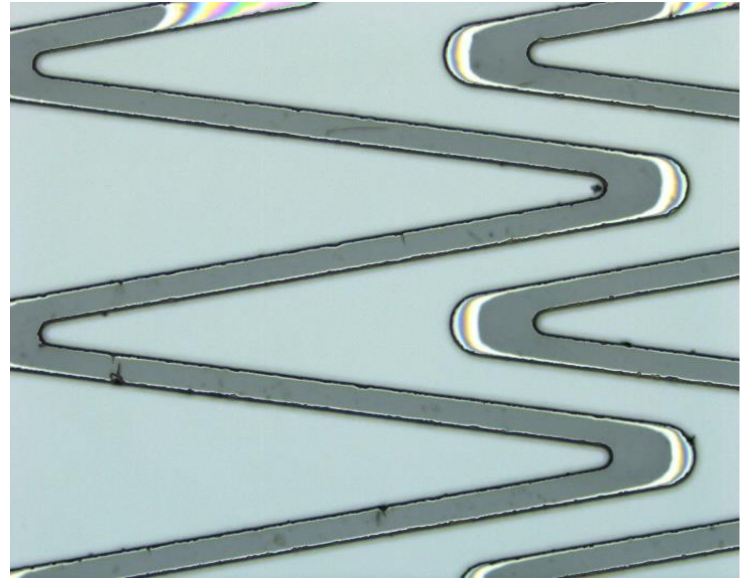

Figure 6 The surface is relatively smooth without any flaws

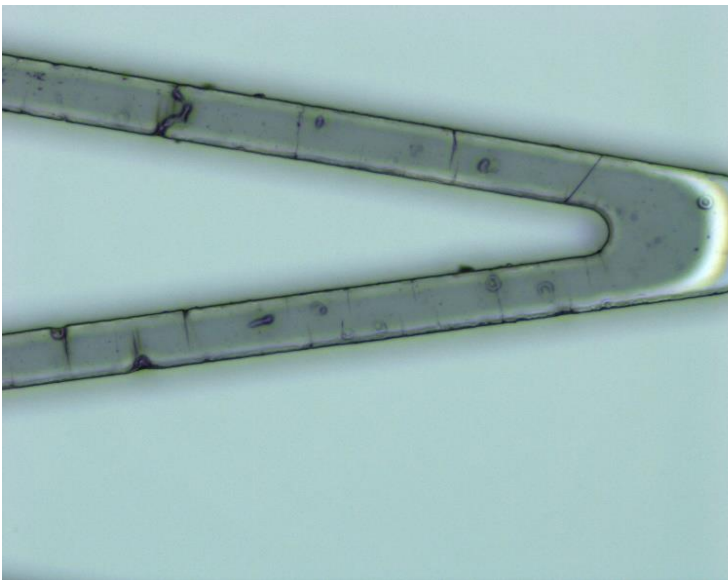

Figure 7 Flaws are evident on the surface of the features

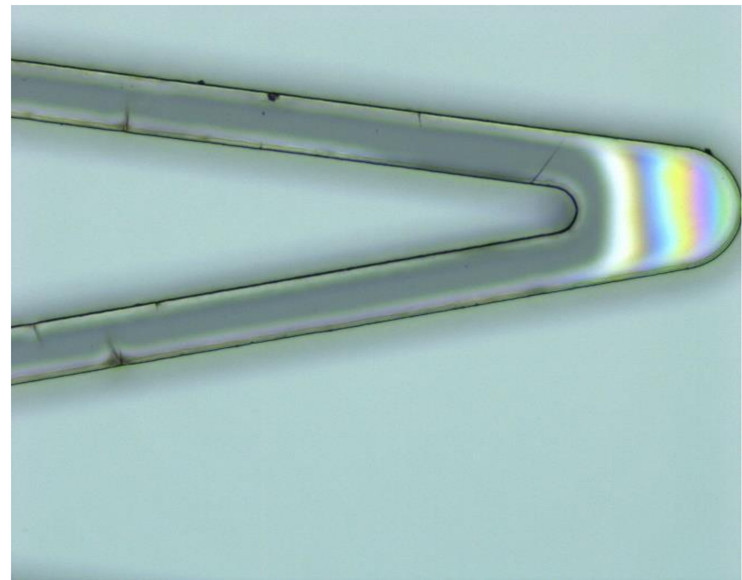

Figure 8 The surface is relatively smooth without any flaws

FIB-SEM images

With LP filter

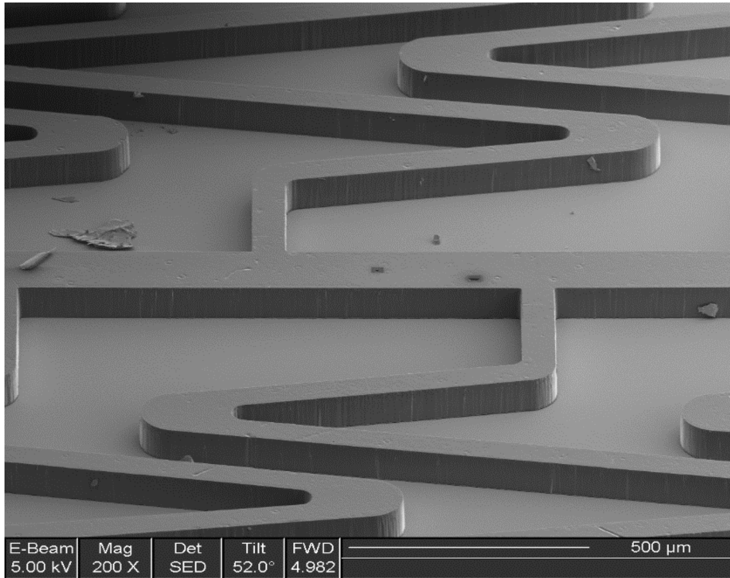

Figure 9 Flaws are evident on the surface of the features

Without LP filter

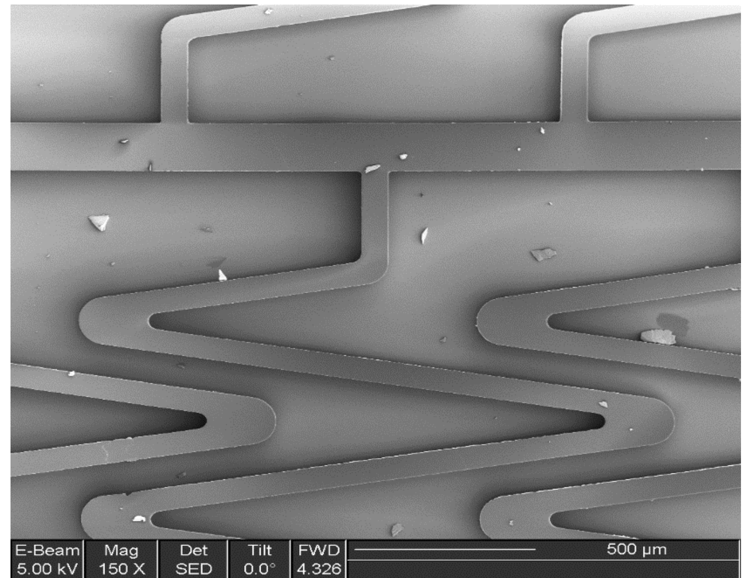

Figure 10 The surface is relatively smooth without any flaws

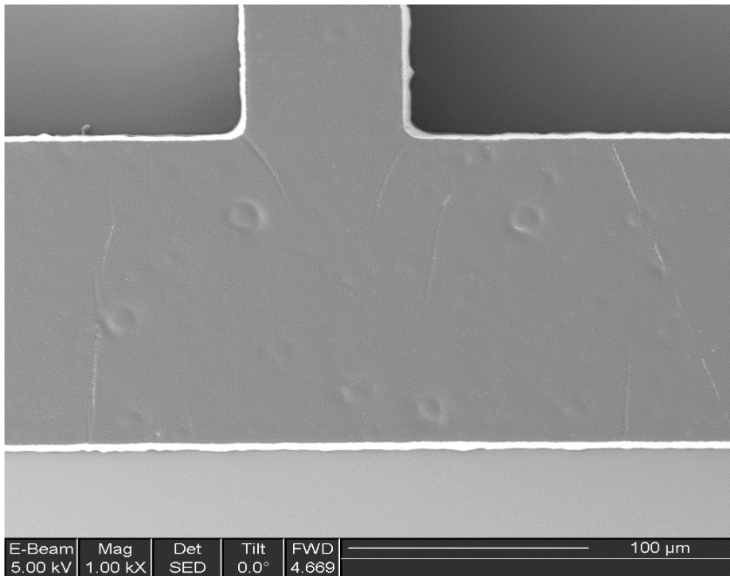

Figure 11 Flaws are evident on the surface of the features

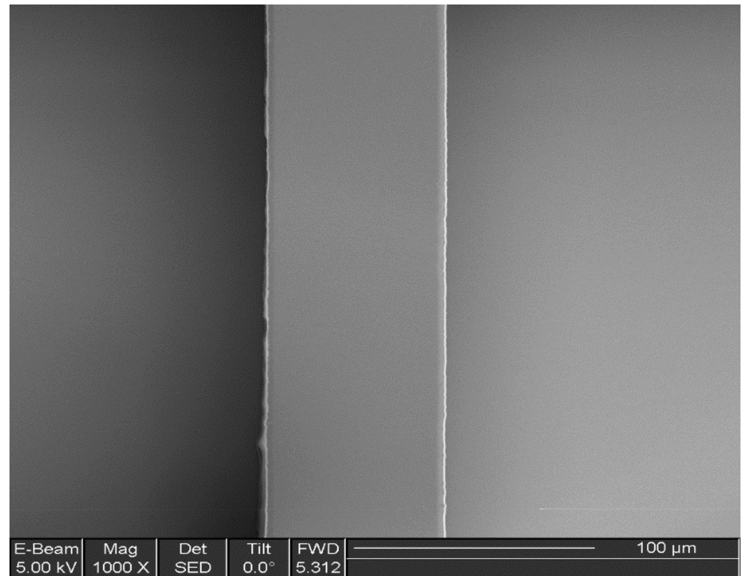

Figure 12 The surface is relatively smooth without any flaws

FIB-SEM images

With LP filter

Without LP filter

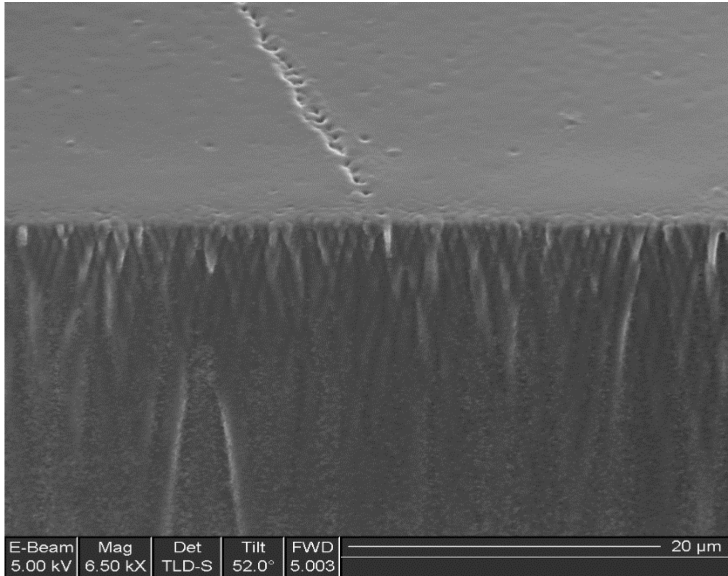

Figure 13 Flaws are evident on the surface of the features

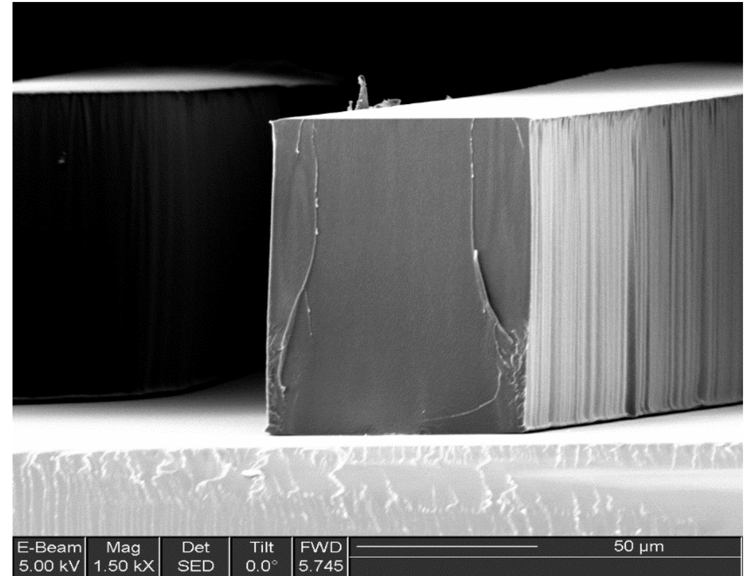

Figure 14 The surface is relatively smooth without any flaws

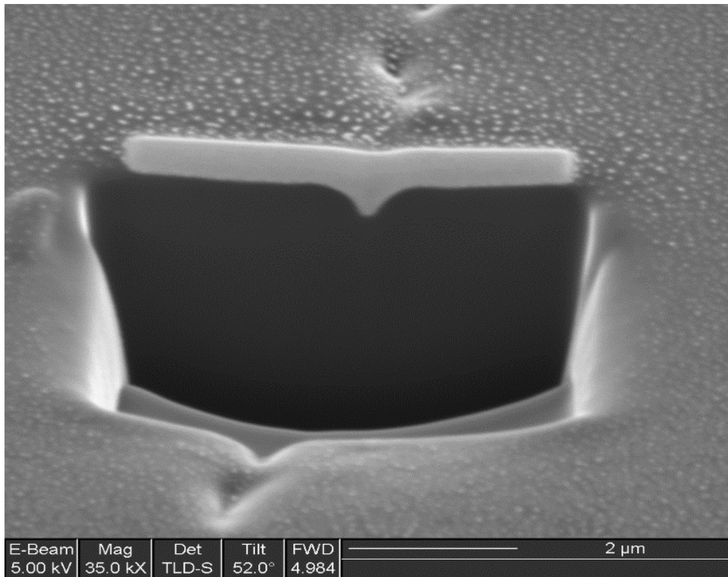

Figure 15 Analysis of the features through etching using FIB confirms that most of the flaws do not extend through the material

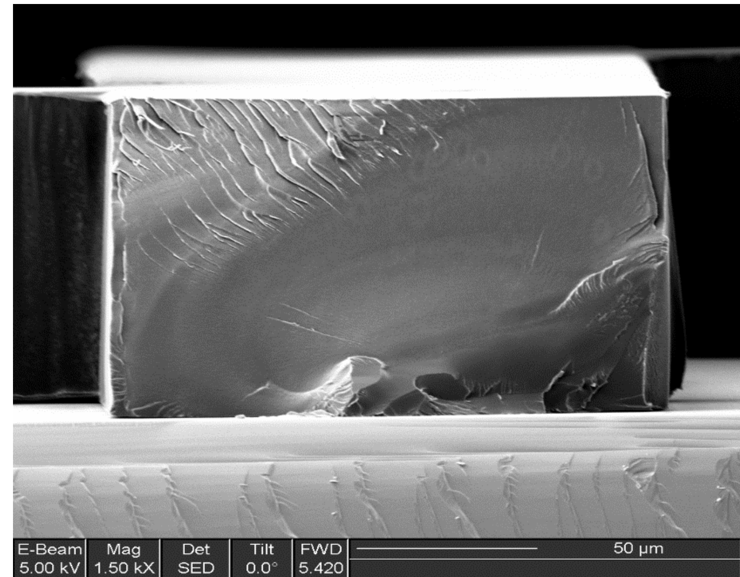

Figure 16 The surface is relatively smooth without any flaws

FIB-SEM images

With LP filter

Without LP filter

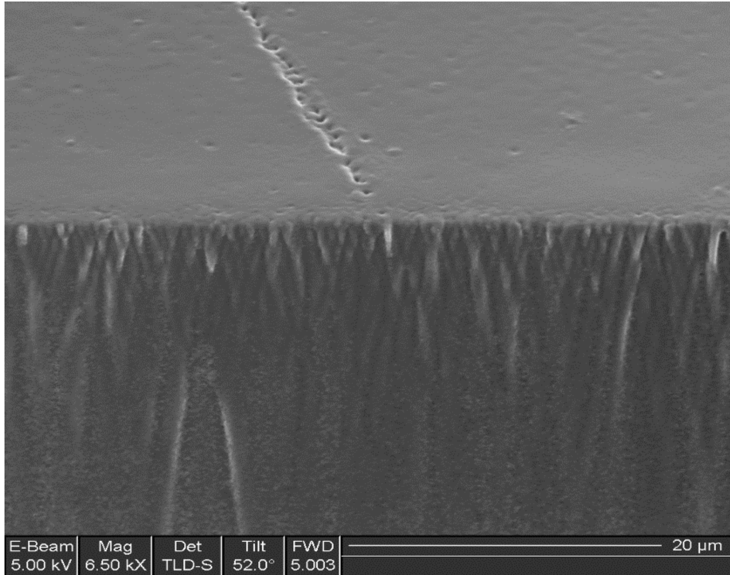

Figure 17 Flaws are evident on the surface of the features

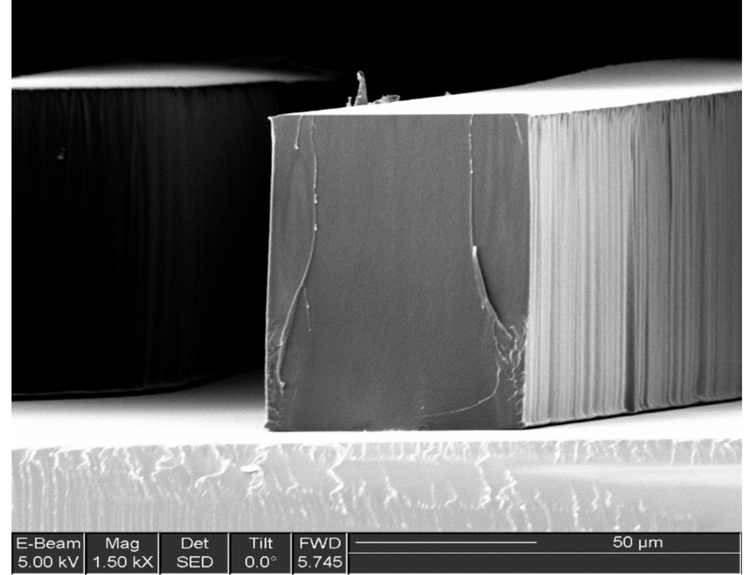

Figure 18 The surface is relatively smooth without any flaws

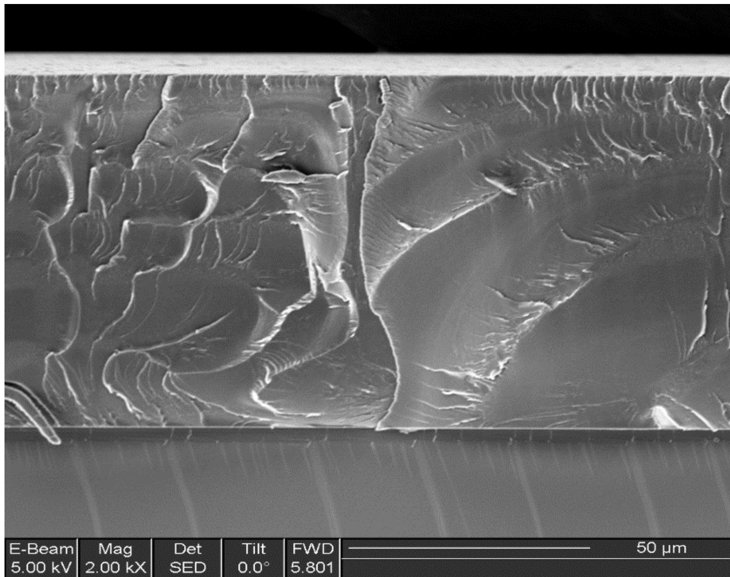

Figure19 These cracks are observed less in numbers when compared to flaws on the surface

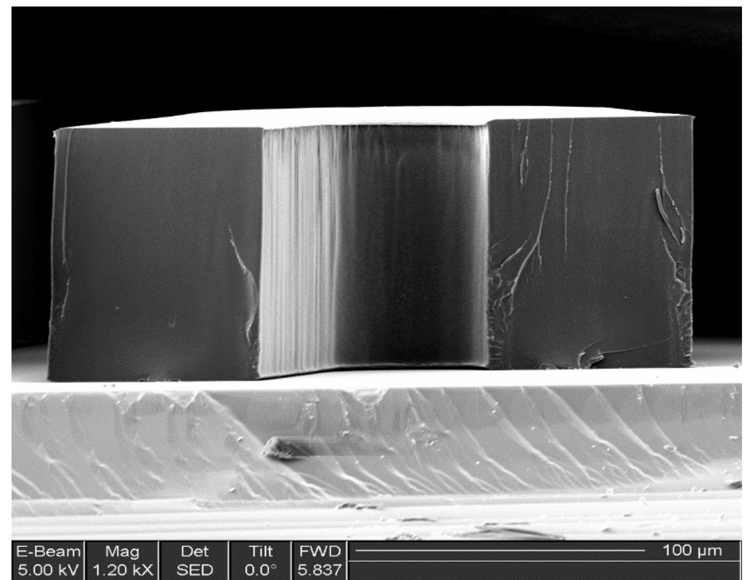

Figure 20 Exposed feature without the filter shows no such cracks

Materials

- SU-8 2050
- 3-inch diameter Silicon wafer
- Mask with features of width 70 Microns (transparency film)
- Long pass filter and Blank
- SU-8 Developer
- Isopropyl alcohol (IPA)

Equipment

- Laurell spinner
- Hotplate
- ABM mask aligner
- Zeiss Axio Imager M2m at 5X optical zoom
- FEI Quanta 600 ESEM

Protocol

- Two Plain wafers with no SiO_2 are baked for 15 minutes at 200 degrees
- 100 µm thickness layer is deposited by spin coating 2050 SU-8 at 1700RPM
- They are subjected to Soft bake at 65 degrees for 5 min and 95 for 20 min
- The first wafer is exposed through blank and the second wafer is exposed through filter. The equivalent exposure dose 230 mJ/Cm^2 after accounting for the energy loss through material, they are subjected to post-exposure bake at 65 degrees for 5 min and 95 for 10 min
- The wafers are developed for 10 min in SU-8 developer, sprayed with IPA and blow dried with Nitrogen gun
- Optical images of fine features are captured
- FIB and SEM images are taken for further analysis of the sample