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10-16-2017

## SU-8 Post Development Bake (Hard Bake) Study

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Gona, Ram Surya and Johnston, Eric D., "SU-8 Post Development Bake (Hard Bake) Study", *Protocols and Reports*. Paper 45.  
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# SU-8 Post Development Bake (Hard Bake) Study

## **Abstract**

Test for annealing of SU-8 surface cracks by post-development bake at various temperatures and times.

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## SU-8 Post Development Bake (Hard Bake) Study

### Critical Factors

The post-development bake (hard bake or final cure step) at different temperatures helps annealing any surface cracks that may be evident after development. 150C for 10 minutes is usually sufficient.

A hard bake or final cure step is added to ensure that SU-8 2000 properties do not change in actual use. SU-8 2000 is a thermal resin and as such its properties can continue to change when exposed to a higher temperature than previously encountered.

Ref: [Effect of Post-Development Bake on Adhesion of SU-8 \( https://repository.upenn.edu/scn\\_protocols/41 \)](https://repository.upenn.edu/scn_protocols/41)

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### Goal

To test for annealing of SU-8 surface cracks by post-development bake at various temperatures and times

### Results

Wafer Treatment	Result	Comments	Image
No Treatment	Surface cracks are evident		Fig: 1,3,5,7,9,11,13,15,17,19,21,23
5 min cure at 150°C	Surface cracks healed	No color change observed	Fig: 2, 4
5 min cure at 250°C	Surface cracks healed	Su-8 changes from gray to brown	Fig: 6, 8
30 min cure at 150°C	Surface cracks healed	No color change observed	Fig: 10, 12
30 min cure at 250°C	Surface cracks healed	Su-8 changes from gray to dark brown	Fig: 14, 16
120 min cure at 150°C	Surface cracks healed	No color change observed	Fig: 18, 20
120 min cure at 250°C	Surface cracks healed	Su-8 changes from gray to dark brown	Fig: 22, 24

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

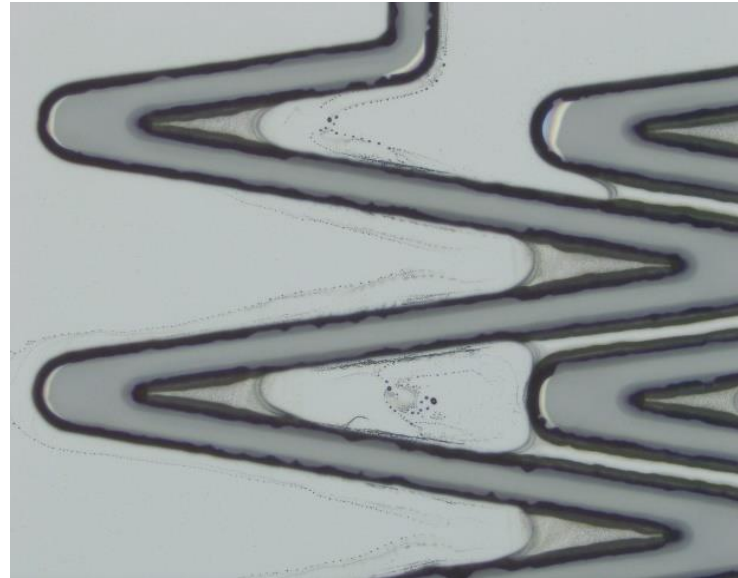
## 5 minute bake at 150C

*Before bake*



*Figure 1: SU-8 features before treatment (The webbing visible due to over exposure does not alter the results of the experiment)*

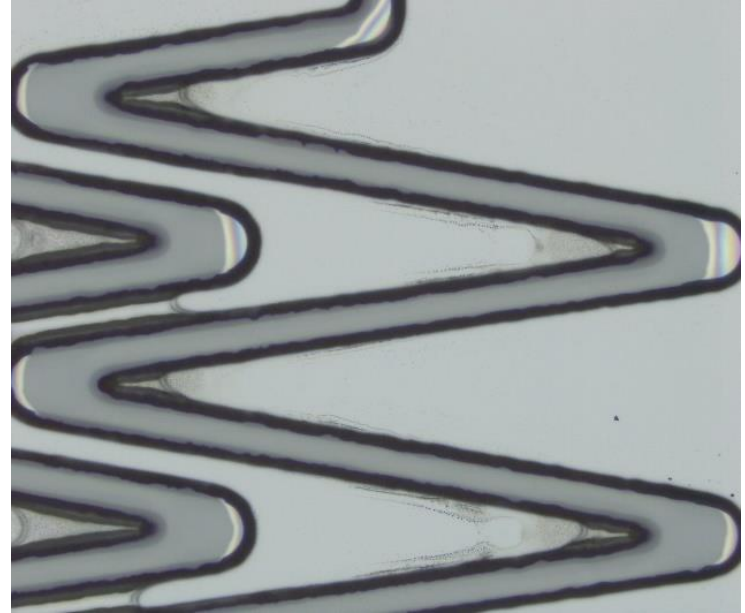
*After bake*



*Figure 2: Surface cracks are healed after 5 min post (The webbing visible due to over exposure does not alter the results of the experiment)*



*Figure 3: SU-8 features before treatment (The webbing visible due to over exposure does not alter the results of the experiment)*

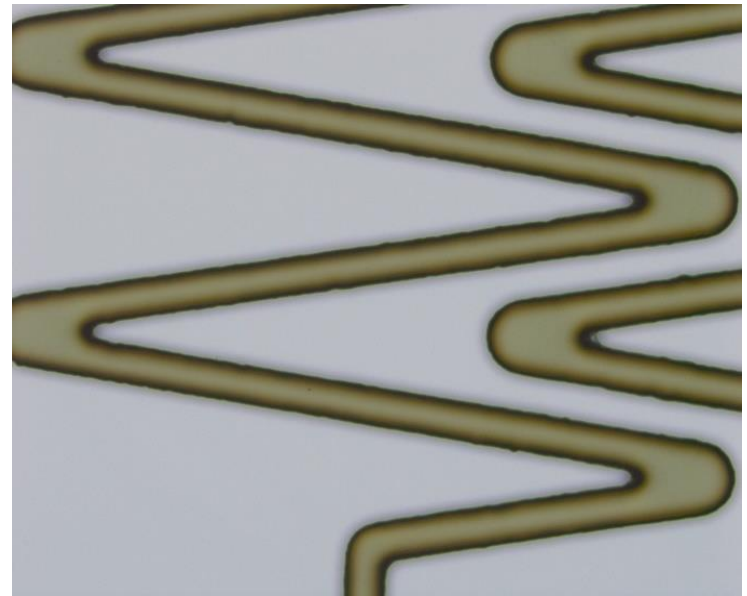
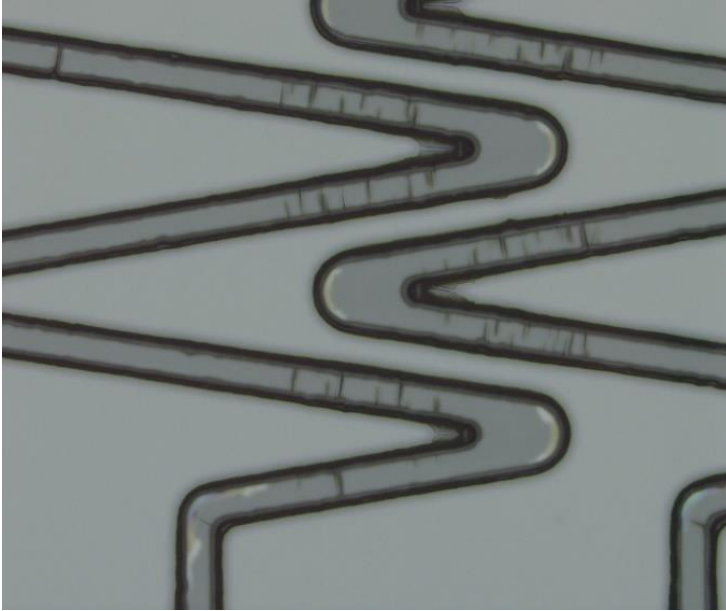


*Figure 4: Surface cracks are healed after 5 min post (The webbing visible due to over exposure does not alter the results of the experiment)*

**5 minute bake at 250C**

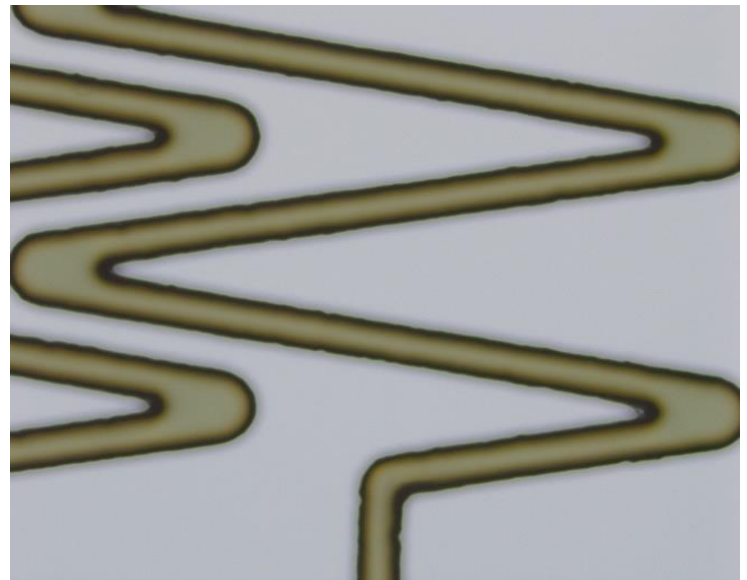
*Before bake*

*After bake*



*Figure 5: SU-8 features before treatment*

*Figure 6: Surface cracks are healed with change in color*



*Figure 7: SU-8 features before treatment*

*Figure 8: Surface cracks are healed with change in color*

**30 minute bake at 150C**

*Before bake*

*After bake*

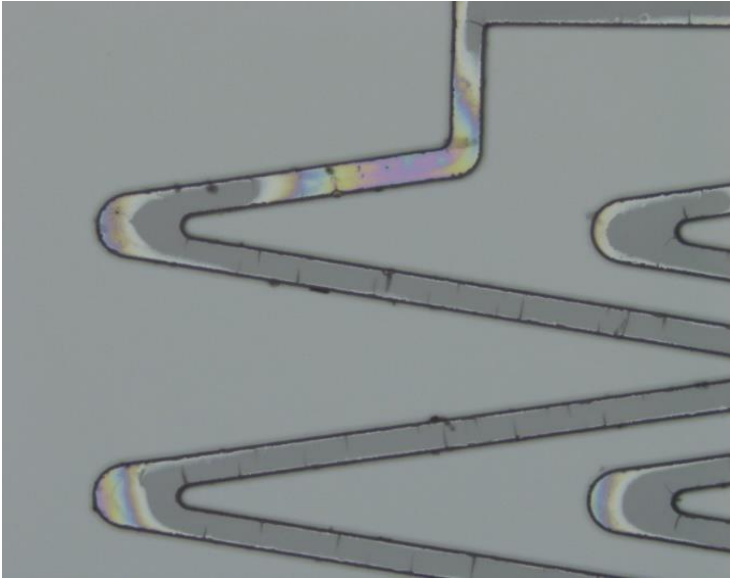


Figure 9: SU-8 features before treatment

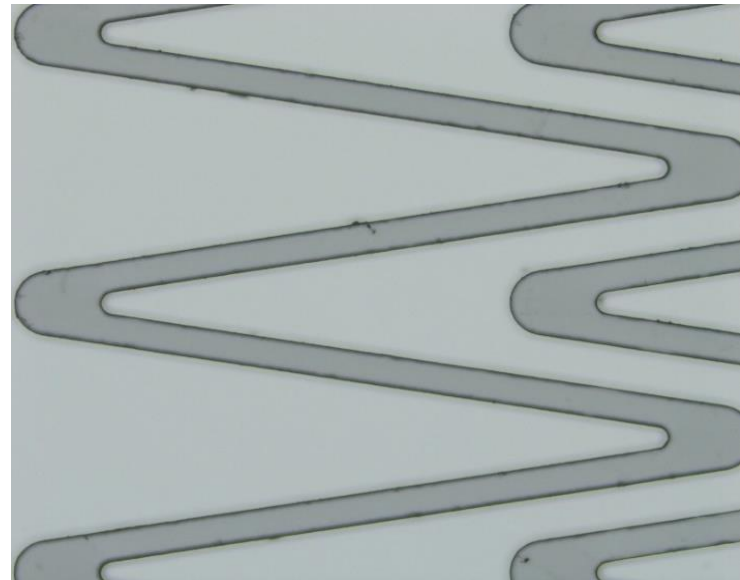


Figure 10: Surface cracks are healed with no color change

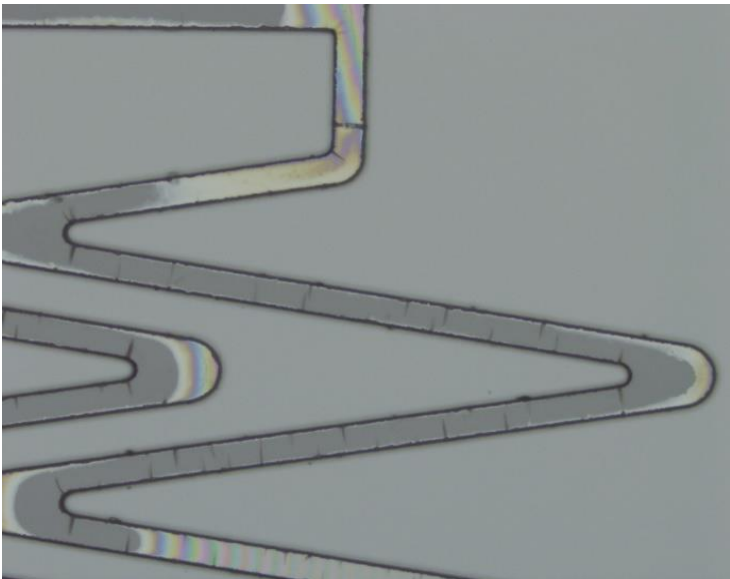


Figure 11: SU-8 features before treatment

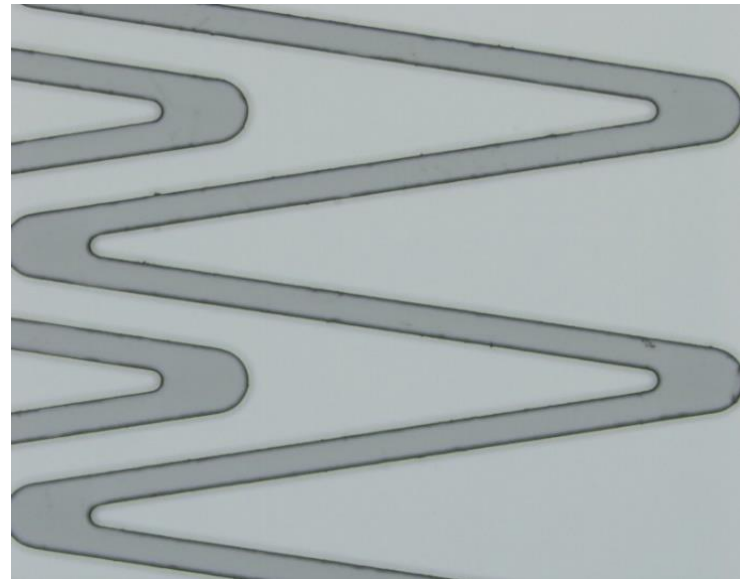


Figure 12: Surface cracks are healed with no color change

### 30 minute bake at 250C

*Before bake*

*After bake*

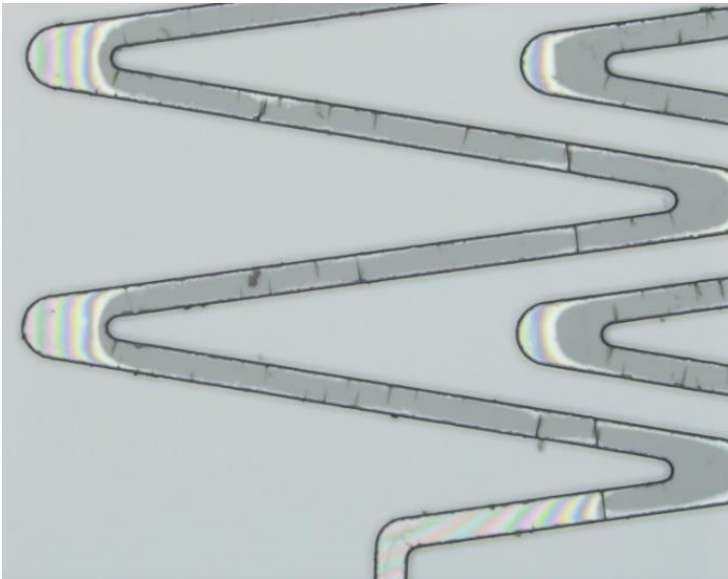


Figure 13: SU-8 features before treatment

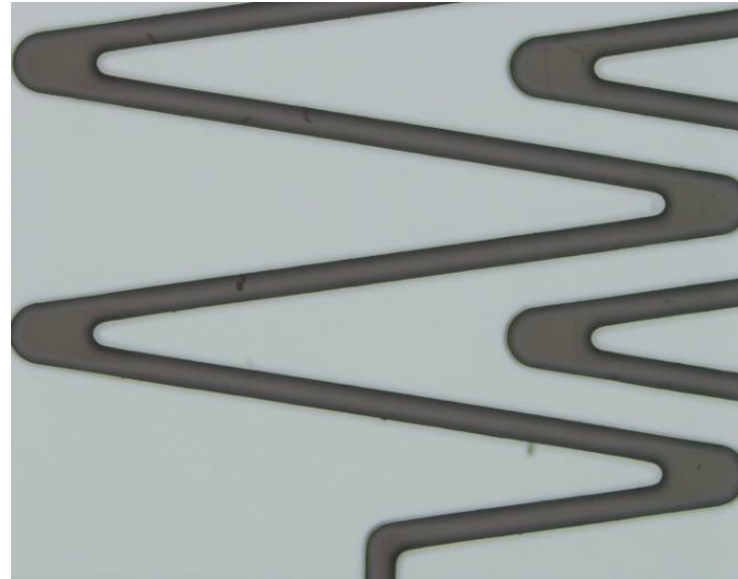


Figure 14: Surface cracks are healed and SU-8 structures change to dark brown

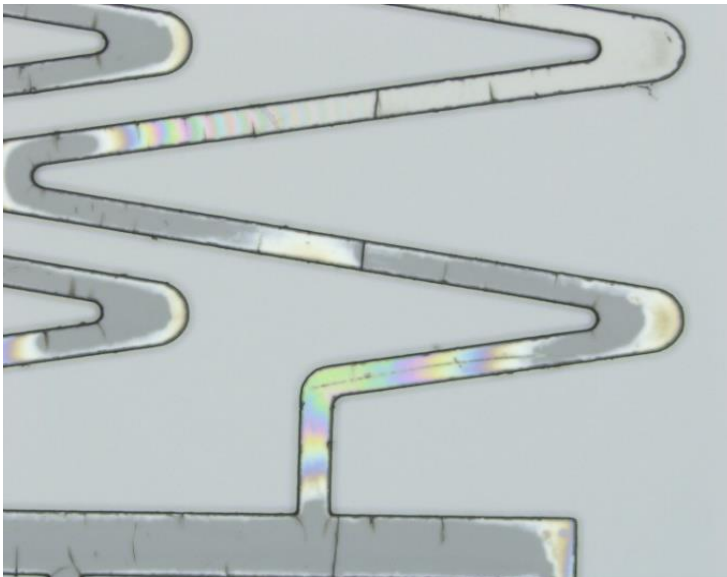


Figure 15: SU-8 features before treatment

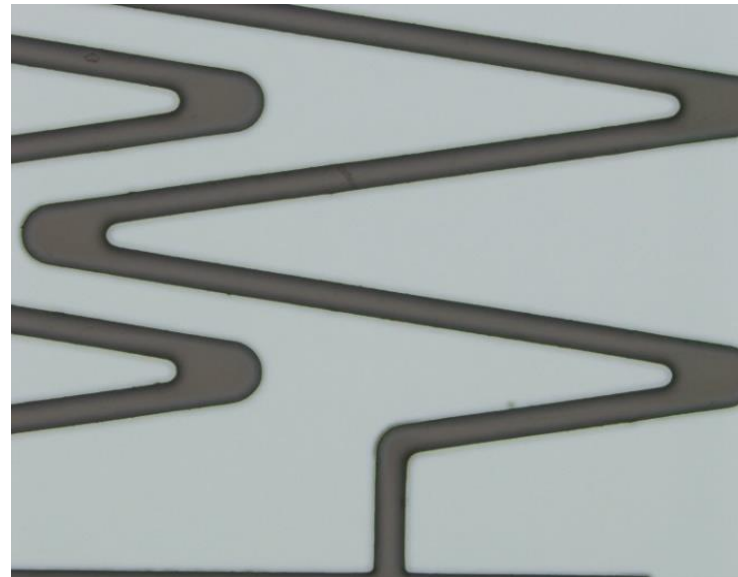


Figure 16: Surface cracks are healed and SU-8 structures change to dark brown

### 120 minute bake at 150C

*Before bake*

*After bake*

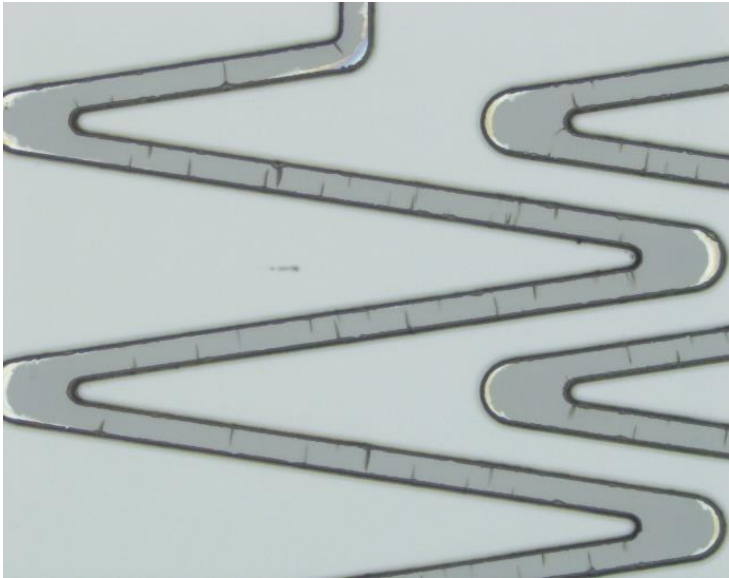


Figure 17: SU-8 features before treatment

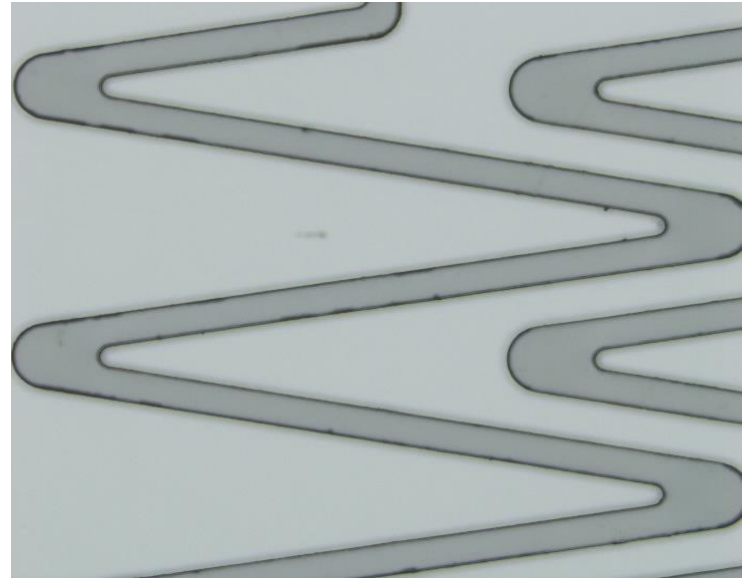


Figure 18: Surface cracks are healed with change in color

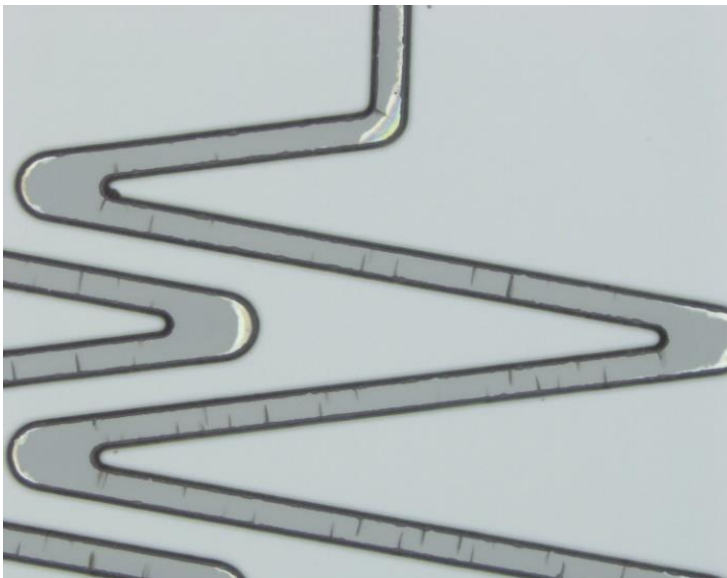


Figure 19: SU-8 features before treatment

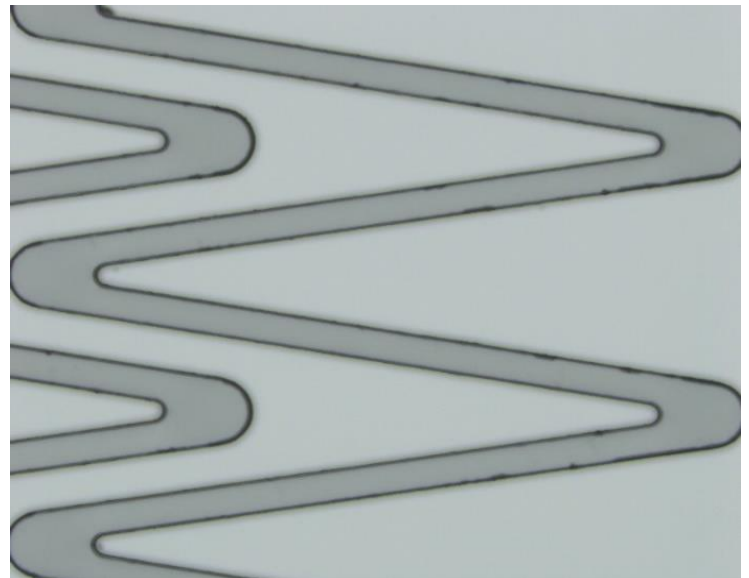


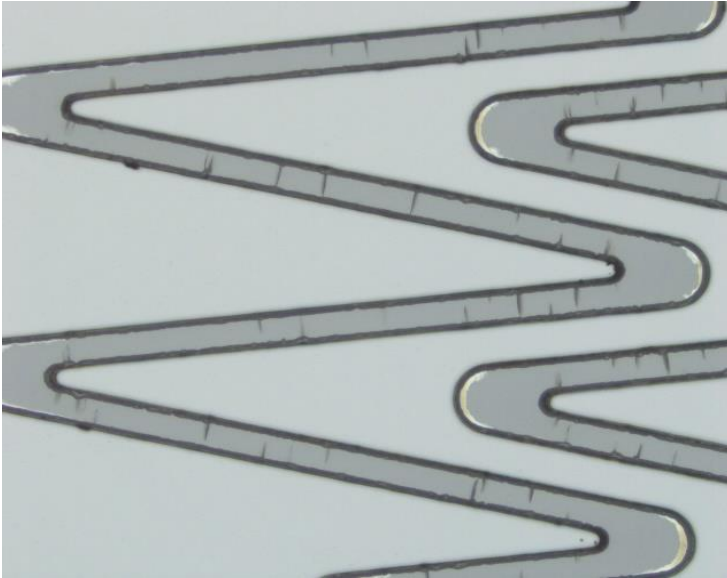
Figure 20: Surface cracks are healed with change in color



**120 minute bake at 250C**

*Before bake*

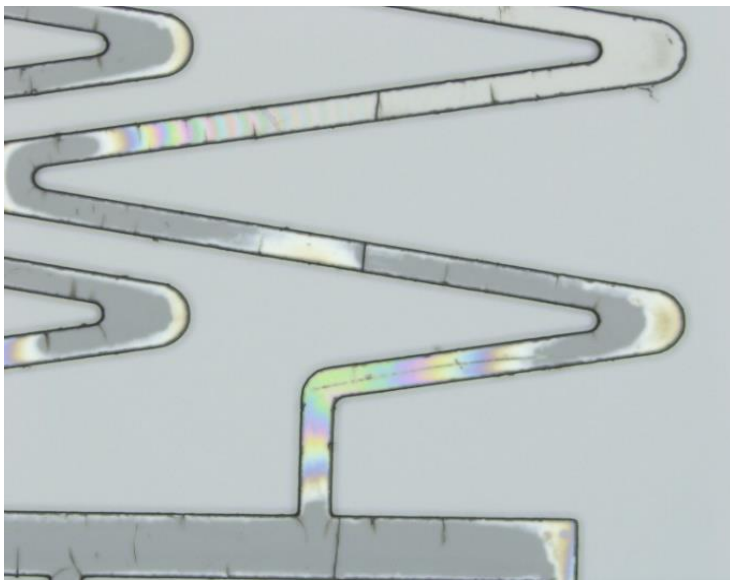
*After bake*



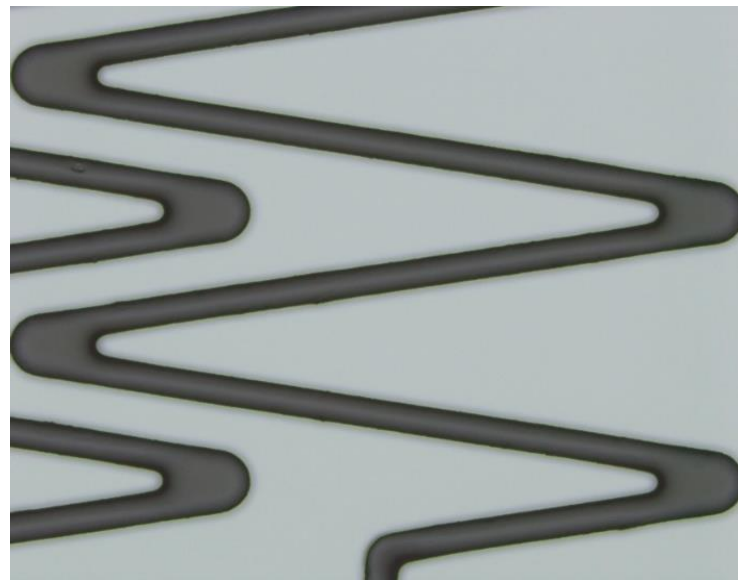
*Figure 21: SU-8 features before treatment*



*Figure 22: Surface cracks are healed and SU-8 structures*



*Figure 23: SU-8 features before treatment*



*Figure 24: Surface cracks are healed and SU-8 structures*

## Materials

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

## Equipment

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

## Protocol

- Plain wafer is baked for 15 minutes at 200C
- 100  $\mu\text{m}$  thickness layer is deposited by spin coating 2050 SU-8 at 1700RPM
- It is subjected to Soft bake at 65C for 5 minutes and 95C for 20 minutes
- After exposing the wafer at specific dose ( $230 \text{ mJ/cm}^2$ ) and time, it is subjected to post-exposure bake at 65C for 5 minutes and 95C for 10 minutes
- The wafer is developed for 10 minutes in SU-8 developer, sprayed with IPA and blow dried with nitrogen gun
- Optical images of fine features are captured
- The wafer is subjected to hard bake at 150C and 250C for 5, 30 and 120 minutes respectively and optical images of the same features are taken for comparison.