



**AZ Electronic Materials**

# **AZ® HiR™ 1075 Photoresist High Resolution i-line Resist**

## **Data Package**

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# AZ HiR 1075 Photoresist

## Process Conditions

### Processing:

Substrate : AZ BARLi II (1300A) on Silicon

Coat: TEL® Mark8 Static dispense. Ttarget = 0.765um Emax

Softbake: 90°C for 60 sec. - proximity mode

Exposure : ASML /250 i-line stepper (Dark Field Image)

Conventional Illumination; NA=0.60  $\sigma = 0.75$

Annular Illumination; NA=0.60 OD / ID = 0.75 / 0.495

Post Exposure Bake :110°C for 90 sec. - proximity mode

Develop : TEL® Mark8 AZ 300MIF single puddle for 60 sec. @ 23°C with agitation

### Analysis :

KLA8100 CD-SEM : each data point taken as the average of two measurement values. CDs measured at bottom of resist profile.

Hitachi S-4000 SEM : SEM pictures taken by cross-section

# AZ HiR 1075 Photoresist

## Optical & Modeling Constants

### Refractive Index :

Unbleached

	365nm	405nm	436nm
n	1.703	1.682	1.649
k	0.020	0.031	0.019

Bleached

	365nm	405nm	436nm
n	1.688	1.659	1.649
k	0.0007	0.0009	0.0012

### Cauchy Coefficients

Unexposed Film

A: 1.6087

B: 0.0059 [ $\mu\text{m}^2$ ]

C: 0.0015 [ $\mu\text{m}^4$ ]

Exposed Film

A: 1.5896

B: 0.0109 [ $\mu\text{m}^2$ ]

C: 0.0001 [ $\mu\text{m}^4$ ]

### Dill ABC bleaching parameters

A( $\mu\text{m}^{-1}$ ) : 0.681

B( $\mu\text{m}^{-1}$ ) : 0.040

C( $\text{cm}^2/\text{mJ}$ ) : 0.018

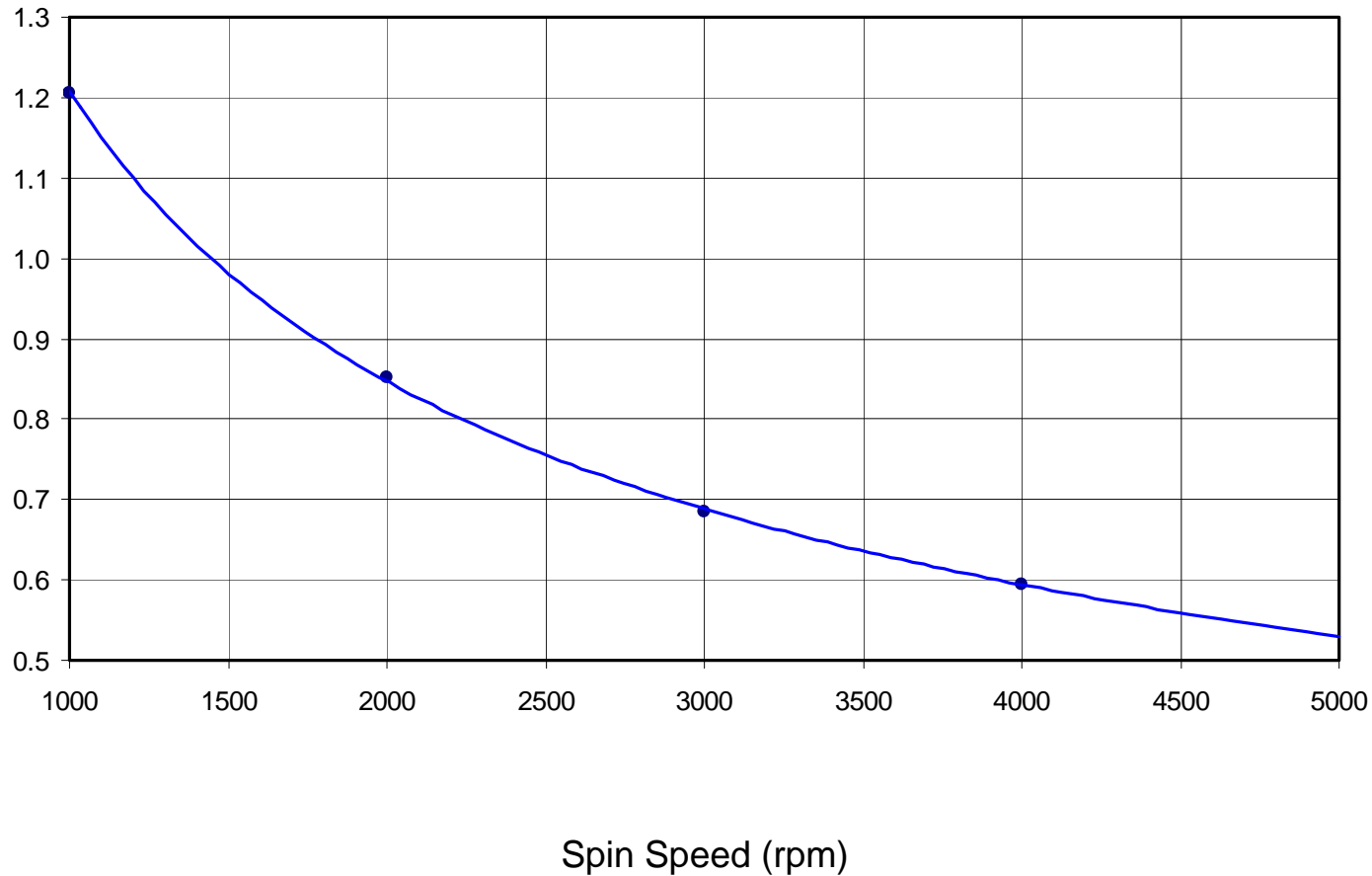


**AZ Electronic Materials**

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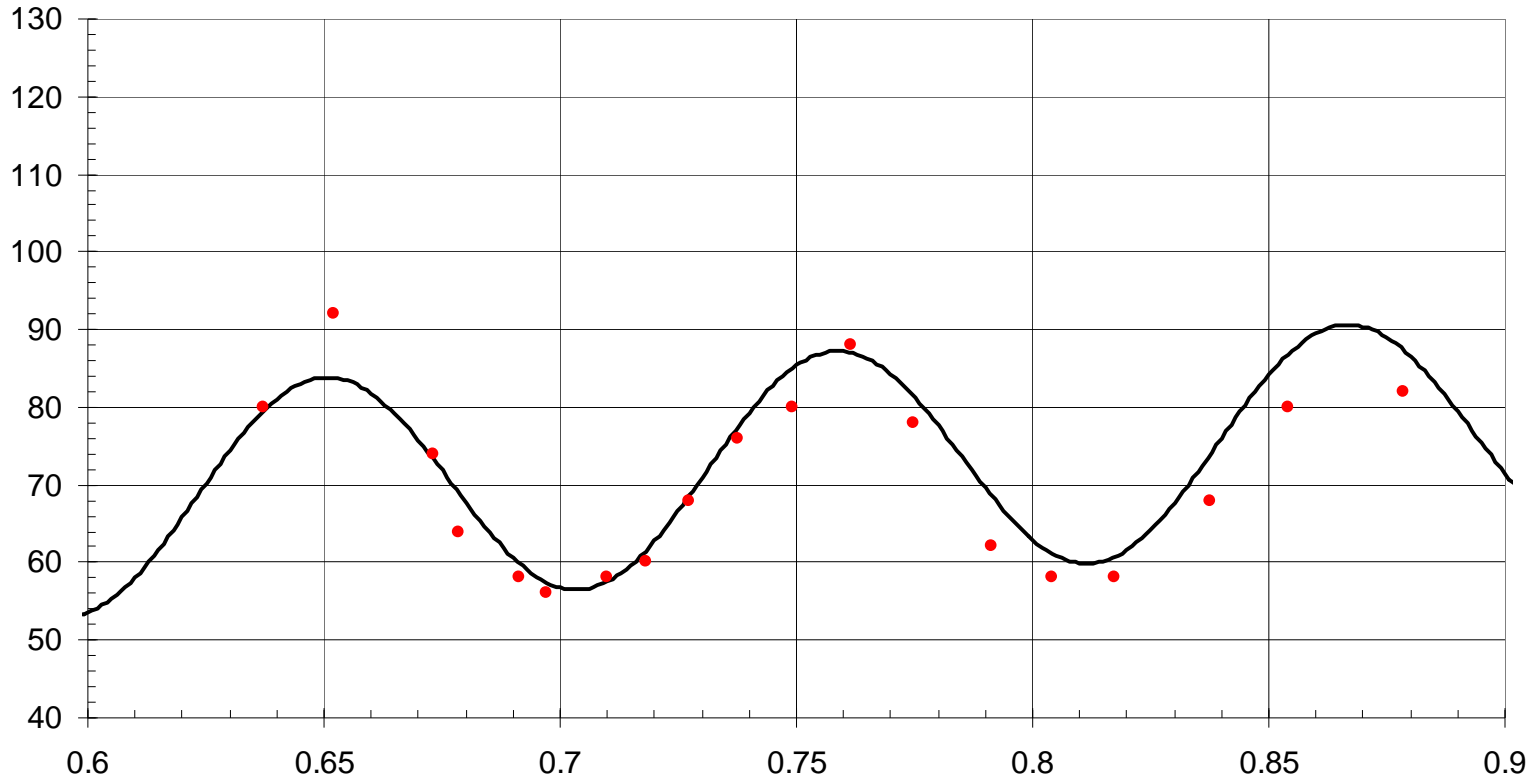
# AZ HiR 1075 Photoresist

## Spin Speed Curve



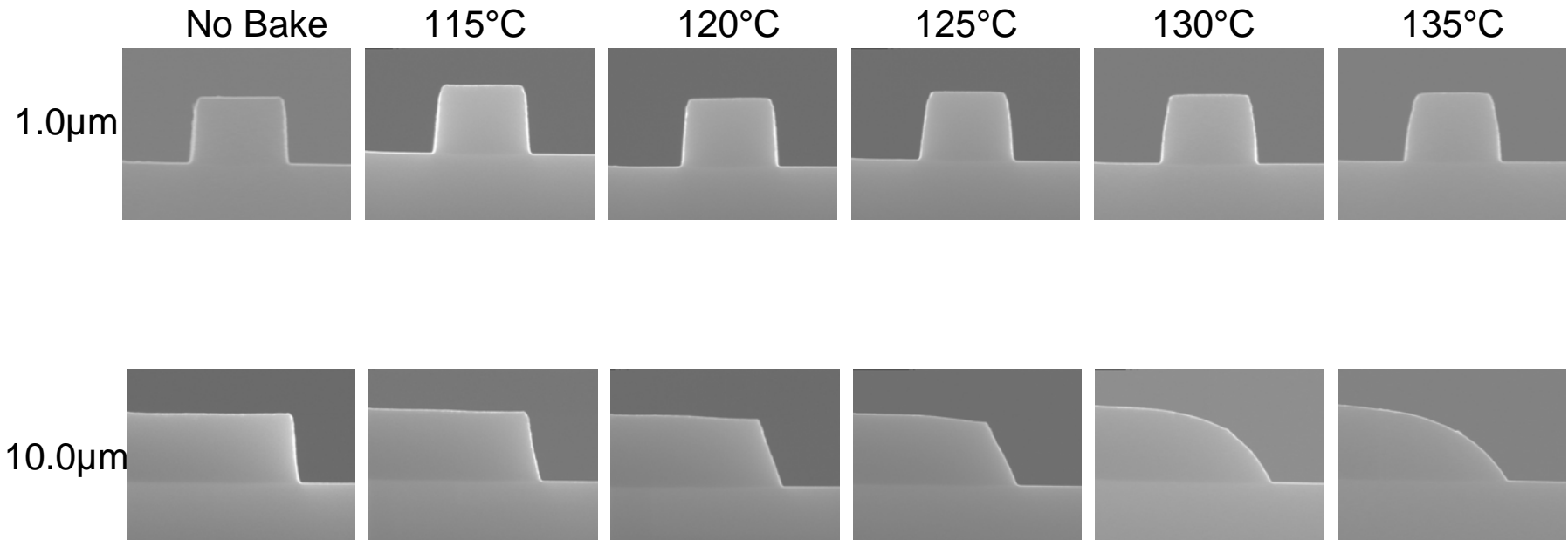


# AZ HiR 1075 Photoresist Swing Curve



# AZ HiR 1075 Photoresist

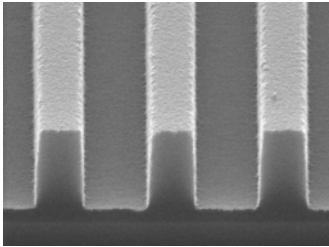
## Thermal Stability



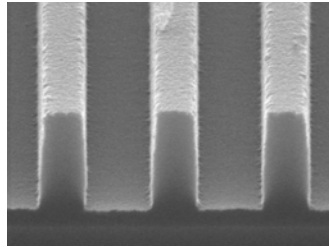
# AZ HiR 1075 Photoresist

## Linearity / Resolution SEMs (Annular)

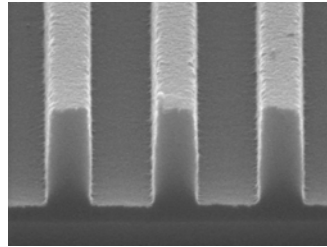
0.50  $\mu\text{m}$



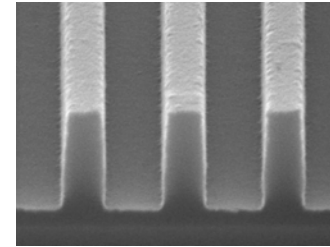
0.40  $\mu\text{m}$



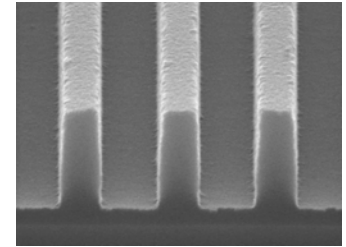
0.38  $\mu\text{m}$



0.36  $\mu\text{m}$

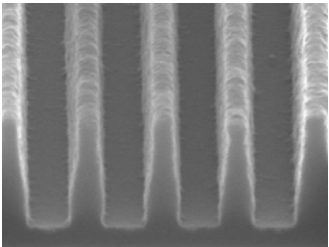
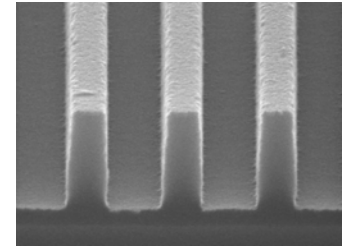


0.35  $\mu\text{m}$

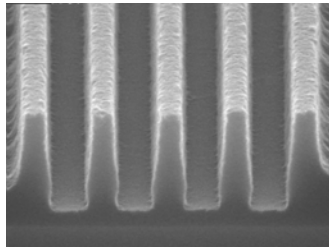


**210 mJ/cm<sup>2</sup> (DTP for 0.30 $\mu\text{m}$  I/s)**

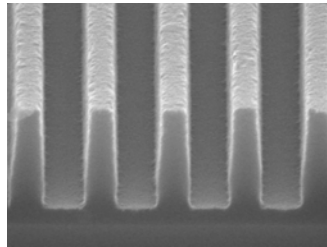
0.34  $\mu\text{m}$



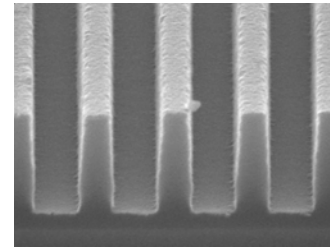
0.22  $\mu\text{m}$



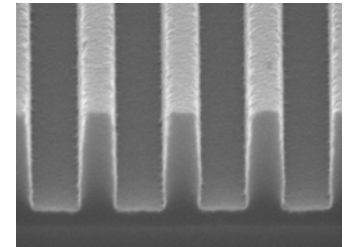
0.24  $\mu\text{m}$



0.26  $\mu\text{m}$



0.28  $\mu\text{m}$



0.30  $\mu\text{m}$

FT: 0.765 $\mu\text{m}$  on AZ BARLi II Coating

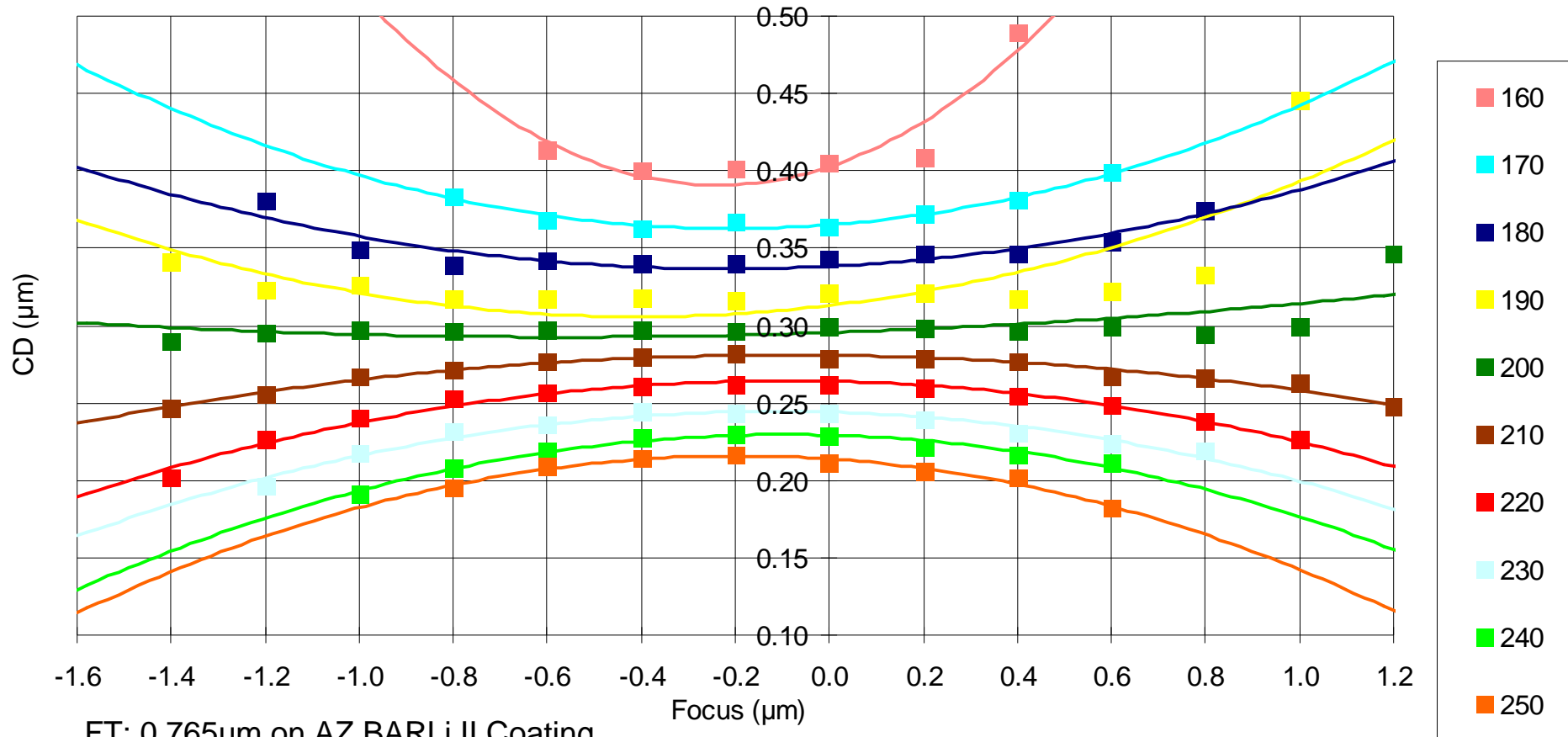
SB : 90C for 60sec proximity, ASML Annular **NA=0.60 / 0.75/0.495 ID/OD sigma**

PEB : 110°for 90sec proximity

Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C

# AZ HiR 1075 Photoresist

## 0.30 $\mu\text{m}$ Dense Lines on AZ BARLi II Coating (Annular)



FT: 0.765 $\mu\text{m}$  on AZ BARLi II Coating

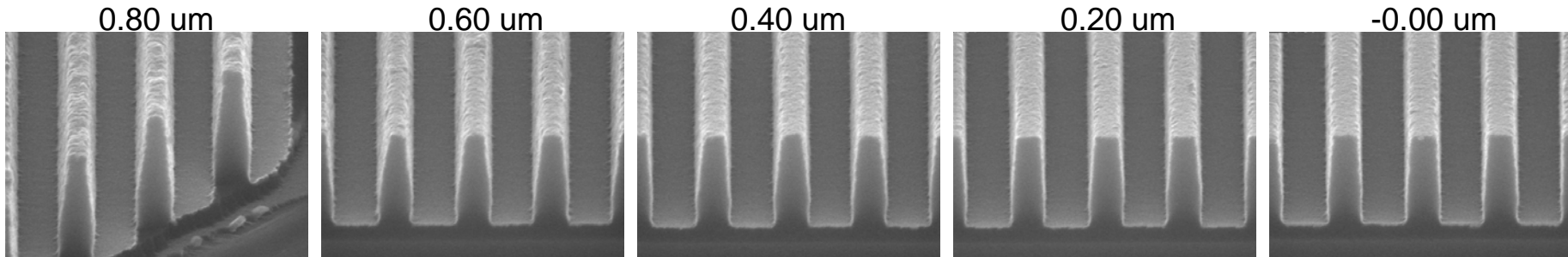
SB : 90C for 60sec proximity, ASML Annular **NA=0.60 / 0.75/0.495 ID/OD sigma**

PEB : 110° for 90sec proximity

Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C

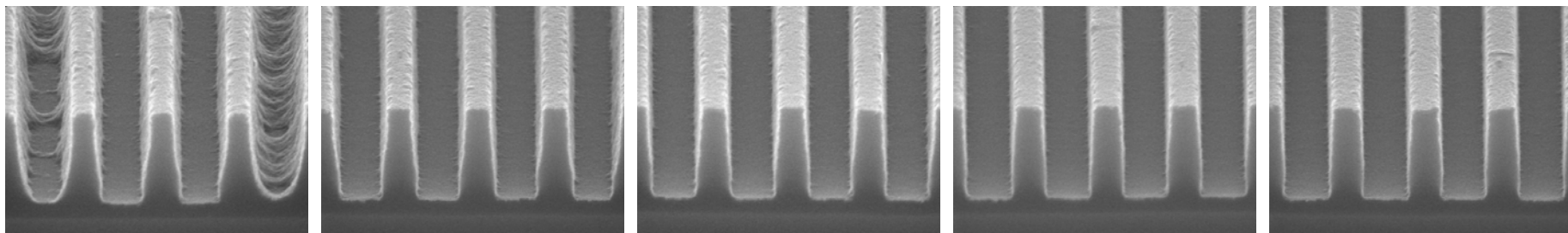
# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.30um (Annular)



**Dense Lines @ 190 mJ/cm<sup>2</sup>**

-0.20 um



-1.4 um      -1.2 um

-1.0 um

-0.60 um

-0.40 um

FT: 0.765um on AZ BARLi II Coating

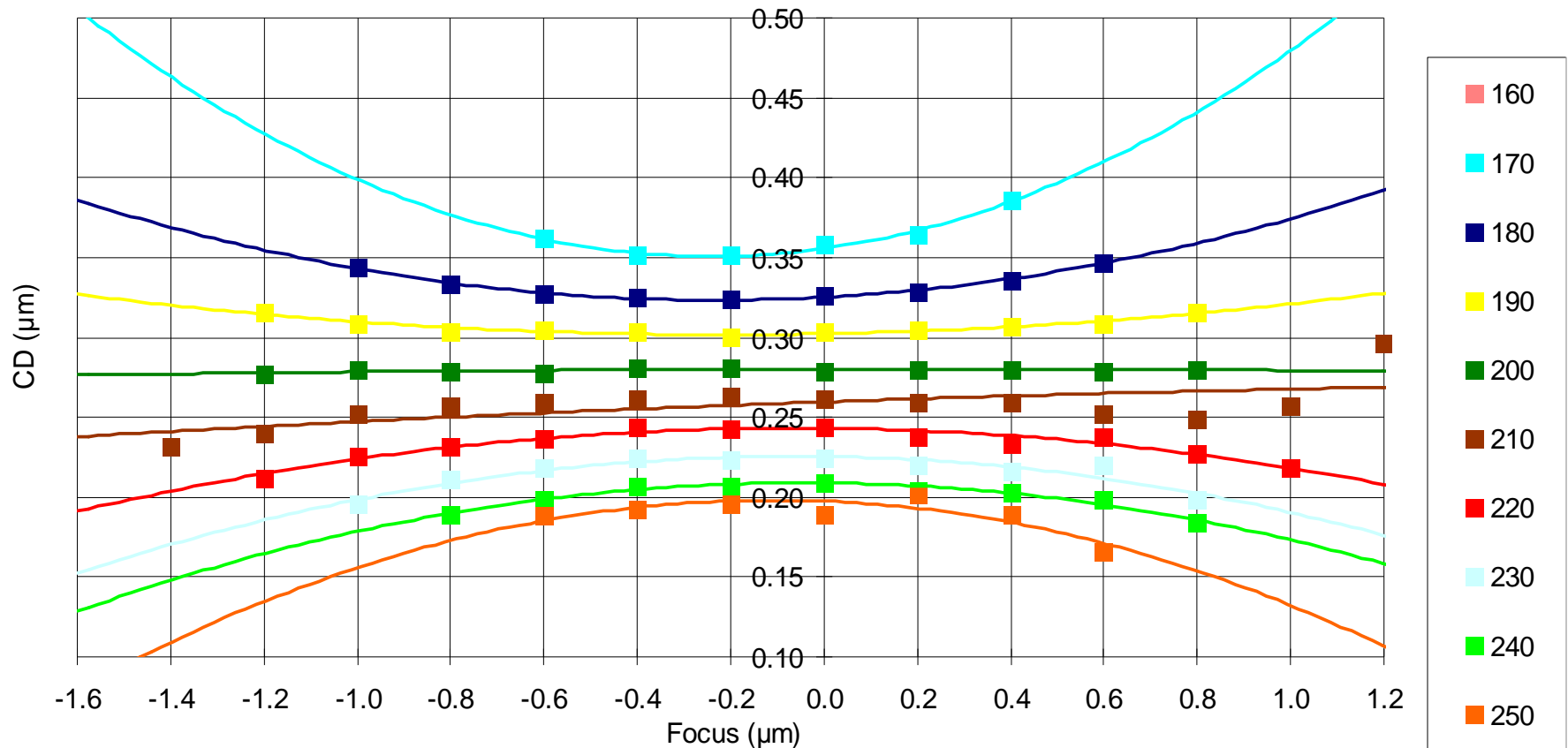
SB : 90C for 60sec proximity, ASML Annular **NA=0.60 / 0.75/0.495 ID/OD sigma**

PEB : 110°for 90sec proximity

Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C

# AZ HiR 1075 Photoresist

## 0.28um Dense Lines on AZ BARLi II Coating (Annular)



FT: 0.765um on AZ BARLi II Coating

SB : 90C for 60sec proximity, ASML Annular **NA=0.60 / 0.75/0.495 ID/OD sigma**

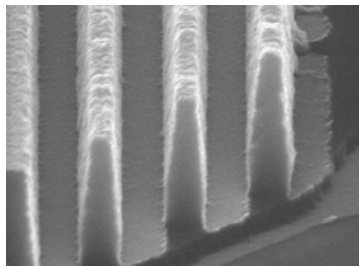
PEB : 110°for 90sec proximity

Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C

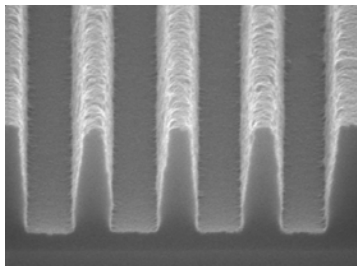
# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.28um (Annular)

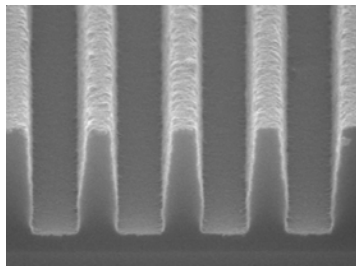
0.80 um



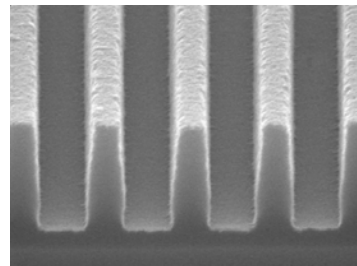
0.60 um



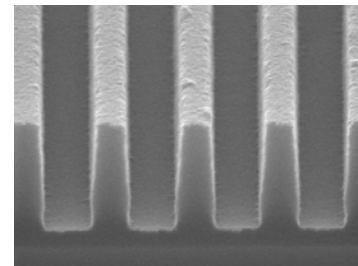
0.40 um



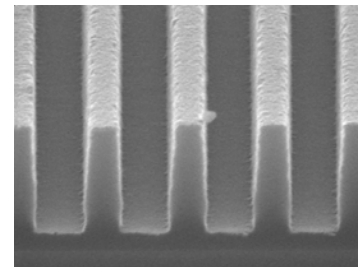
0.20 um



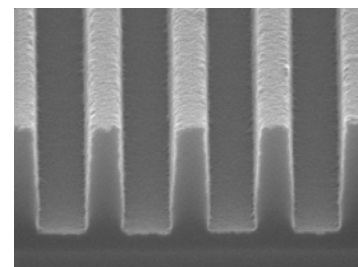
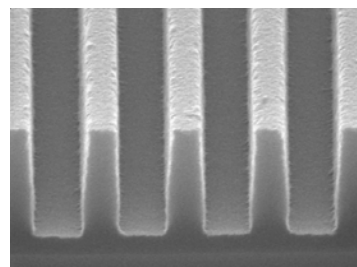
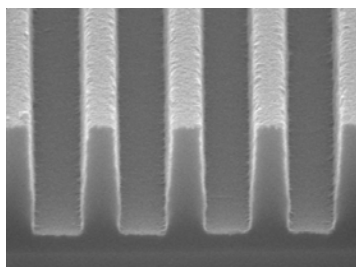
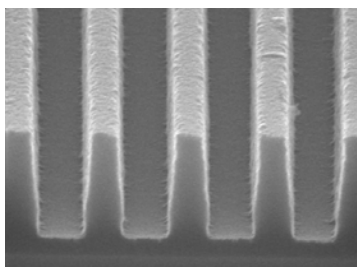
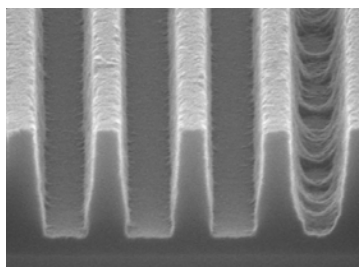
-0.00 um



-0.20 um



**Dense Lines @ 190 mJ/cm<sup>2</sup>**



-1.2 um

-1.0 um

-0.8 um

-0.60 um

-0.40 um

FT: 0.765um on AZ BARLi II Coating

SB : 90C for 60sec proximity, ASML Annular **NA=0.60 / 0.75/0.495 ID/OD sigma**

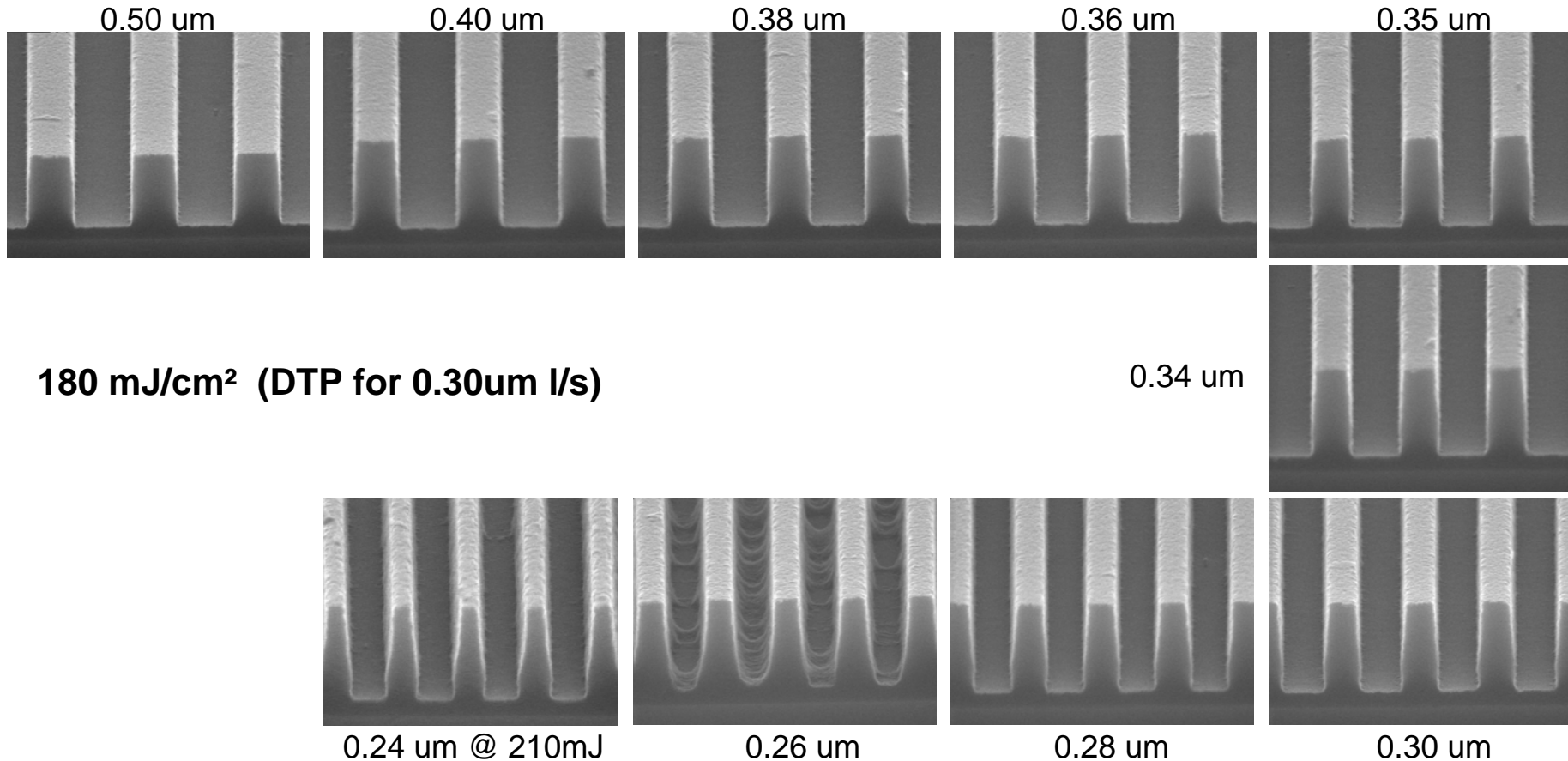
PEB : 110°for 90sec proximity

Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C



# AZ HiR 1075 Photoresist

## Linearity / Resolution SEMs (Conventional)



FT 0.765um on AZ BARLi II Coating

SB : 90C for 60sec proximity, ASML Conventional **NA=0.60 / 0.75sigma**

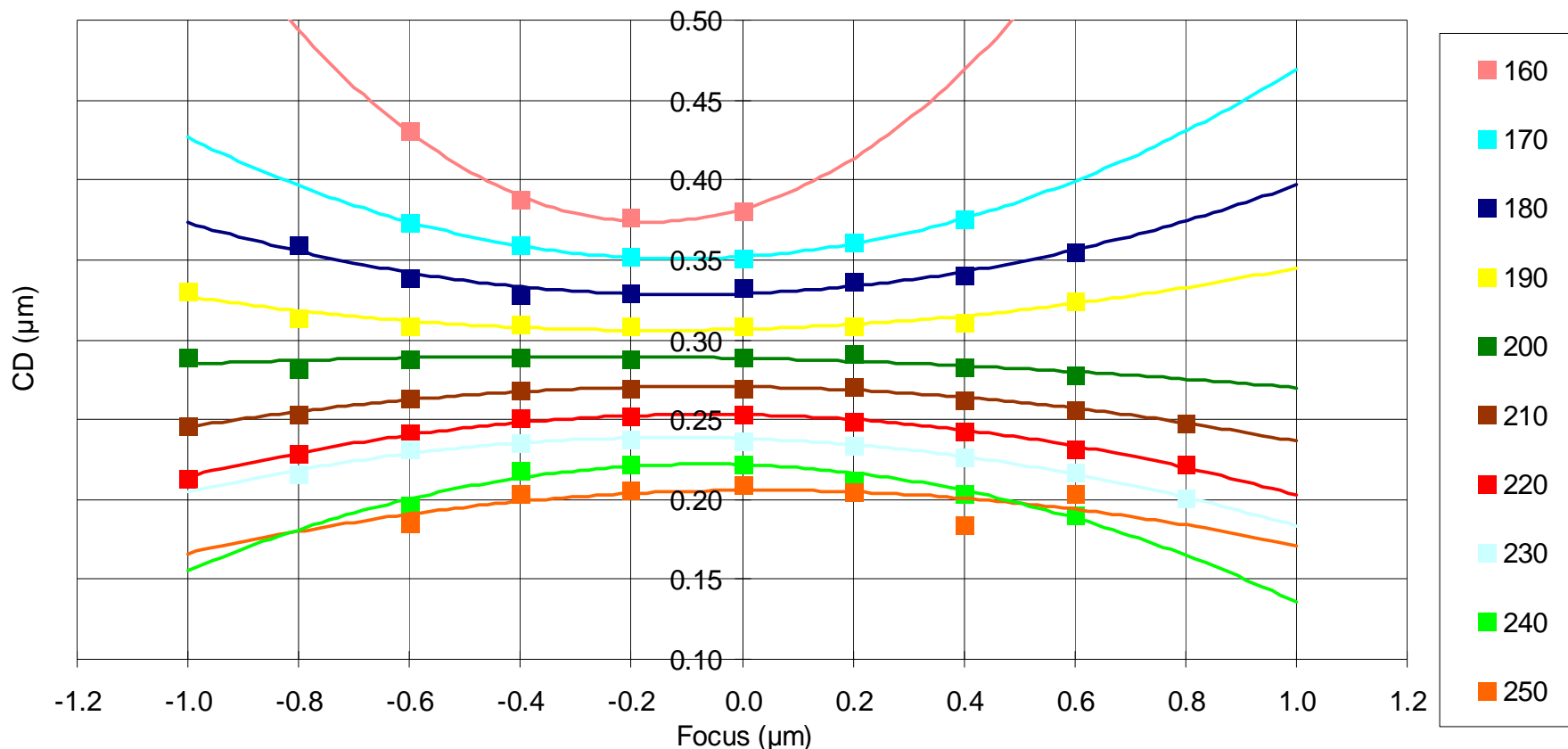
PEB : 110°for 90sec proximity

Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C



# AZ HiR 1075 Photoresist

## 0.30 $\mu$ m Dense Lines on AZ BARLi II Coating (Conventional)



FT 0.765 $\mu$ m on AZ BARLi II Coating

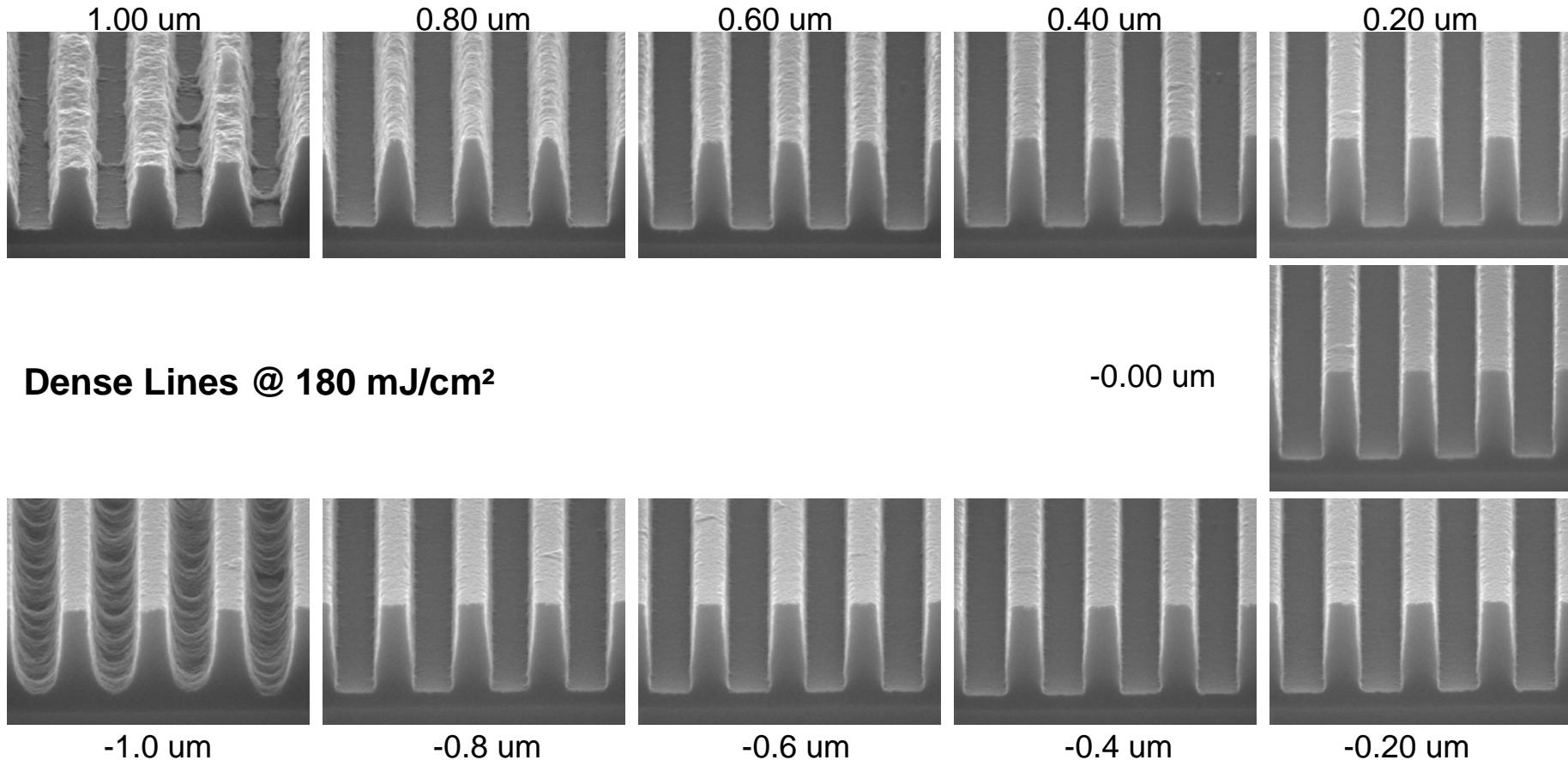
SB : 90C for 60sec proximity, ASML Conventional **NA=0.60 / 0.75sigma**

PEB : 110°for 90sec proximity

Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C

# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.30um (Conventional)



FT: 0.765um on AZ BARLi II Coating

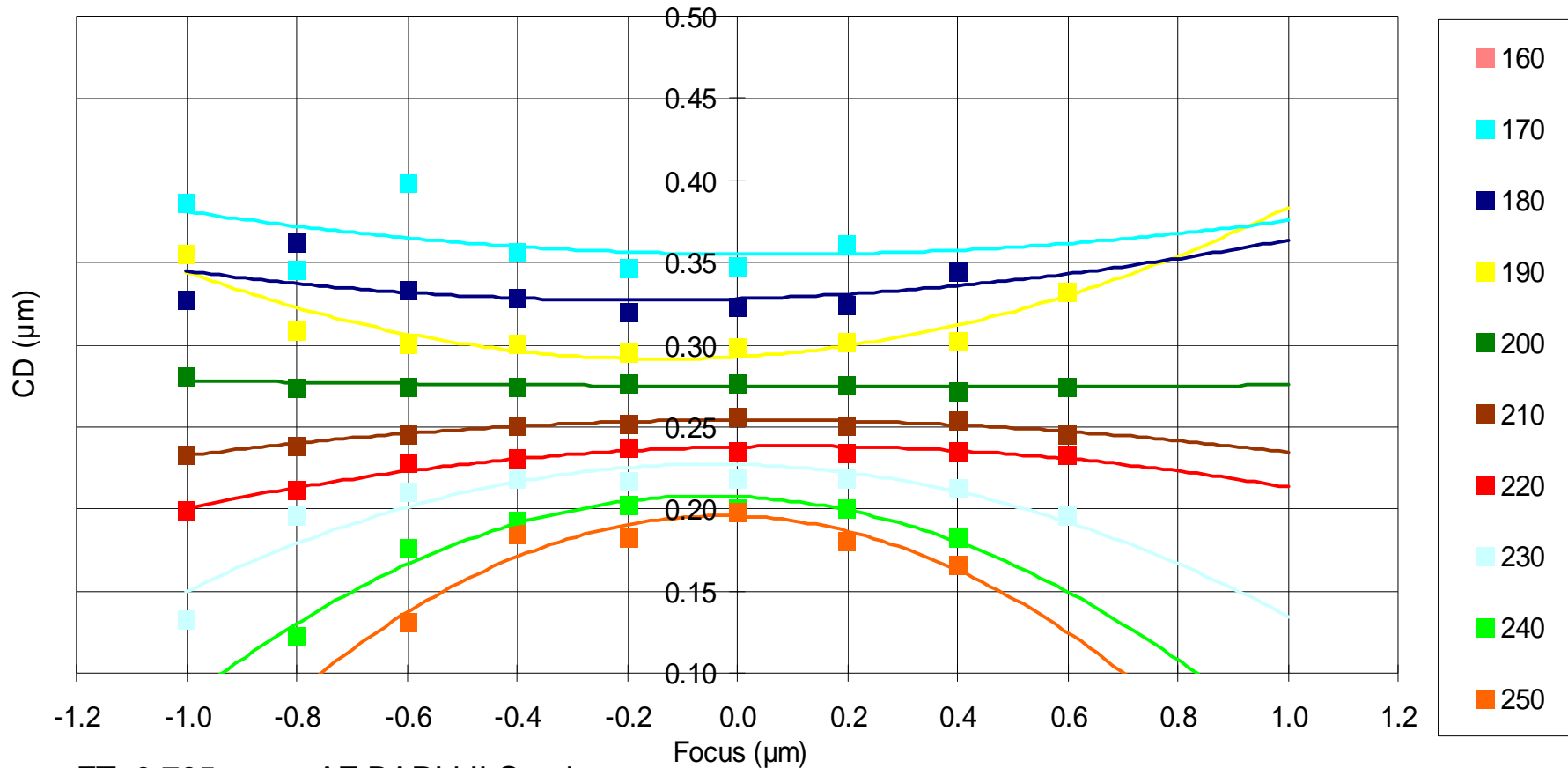
SB : 90C for 60sec proximity, ASML Conventional **NA=0.60 / 0.75sigma**

PEB : 110°for 90sec proximity

Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C

# AZ HiR 1075 Photoresist

## 0.28um Dense Lines on AZ BARLi II Coating (Conventional)



FT: 0.765um on AZ BARLi II Coating

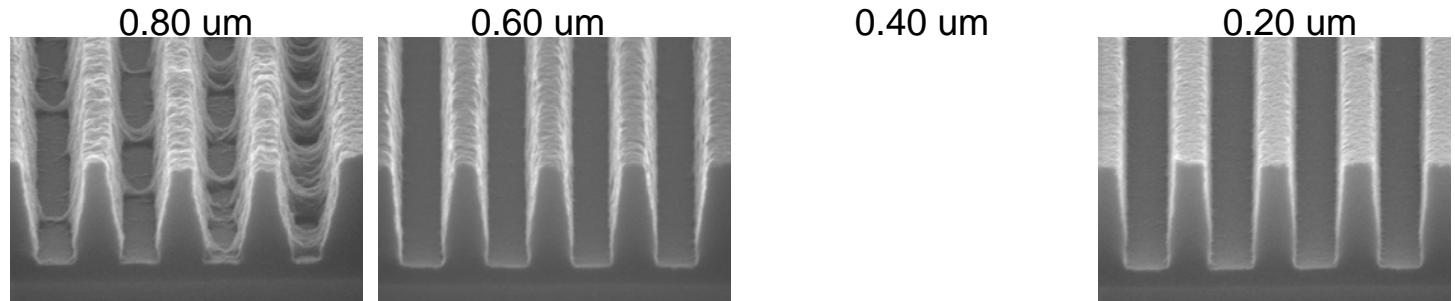
SB : 90C for 60sec proximity, ASML Conventional **NA=0.60 / 0.75sigma**

PEB : 110°for 90sec proximity

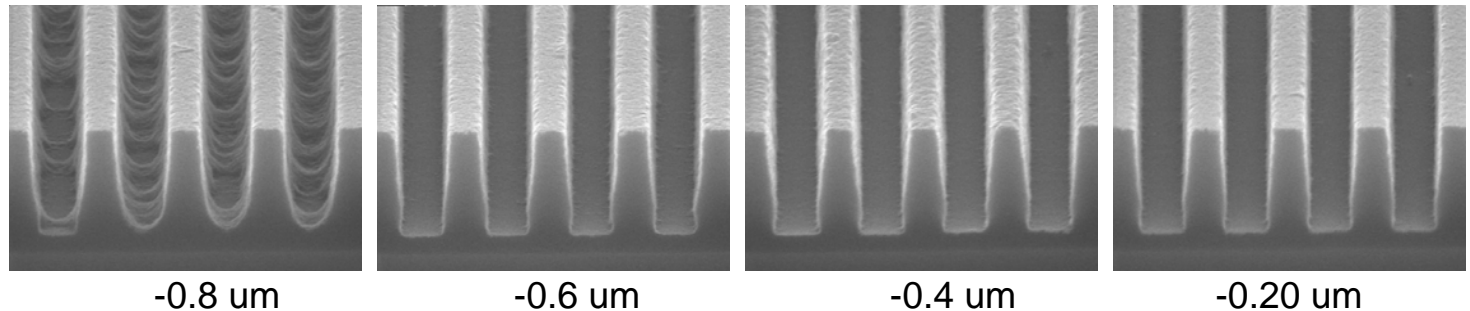
Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C

# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.28um (Conventional)



**Dense Lines @ 180 mJ/cm<sup>2</sup>**



FT: 0.765um on AZ BARLi II Coating

SB : 90C for 60sec proximity, ASML Conventional **NA=0.60 / 0.75sigma**

PEB : 110°for 90sec proximity

Develop: AZ 300 MIF Developer/ Single puddle with agitation for 60 sec @ 23°C

# AZ HiR 1075 Photoresist

## Process Conditions

### Processing:

Coat: FSI® Polaris 2100 Static dispense.

Softbake: 90°C for 60 sec. - proximity mode

Exposure : ASML /400 i-line scanner (Dark Field Image)

Conventional Illumination  $NA=0.65/\sigma = 0.85$

Annular Illumination  $NA=0.65/ OD/ID = 0.85/0.55$

Post Exposure Bake : 110°C for 90 sec. - proximity mode

Develop : FSI® Polaris 2100 0.261N TMAH single puddle for 60sec @ 21°C

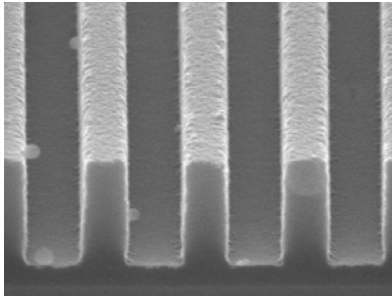
### Analysis :

Hitachi S-4000 SEM : SEM pictures taken by cross-section

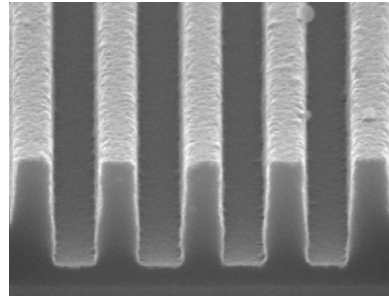
# AZ HiR 1075 Photoresist

## Linearity / Resolution SEMs

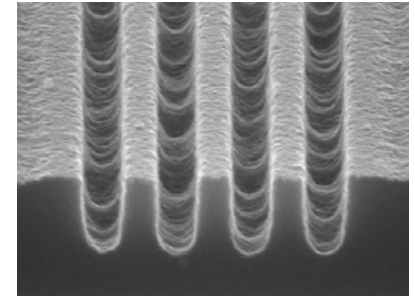
0.30  $\mu\text{m}$



0.25  $\mu\text{m}$



0.22  $\mu\text{m}$



**Dense Lines @ 190 mJ/cm<sup>2</sup>**

@ DTP for 0.30 $\mu\text{m}$  l/s  
- darkfield reticle

FT: 0.66 $\mu\text{m}$  on 1300Å AZ BARLi II Coating

SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55

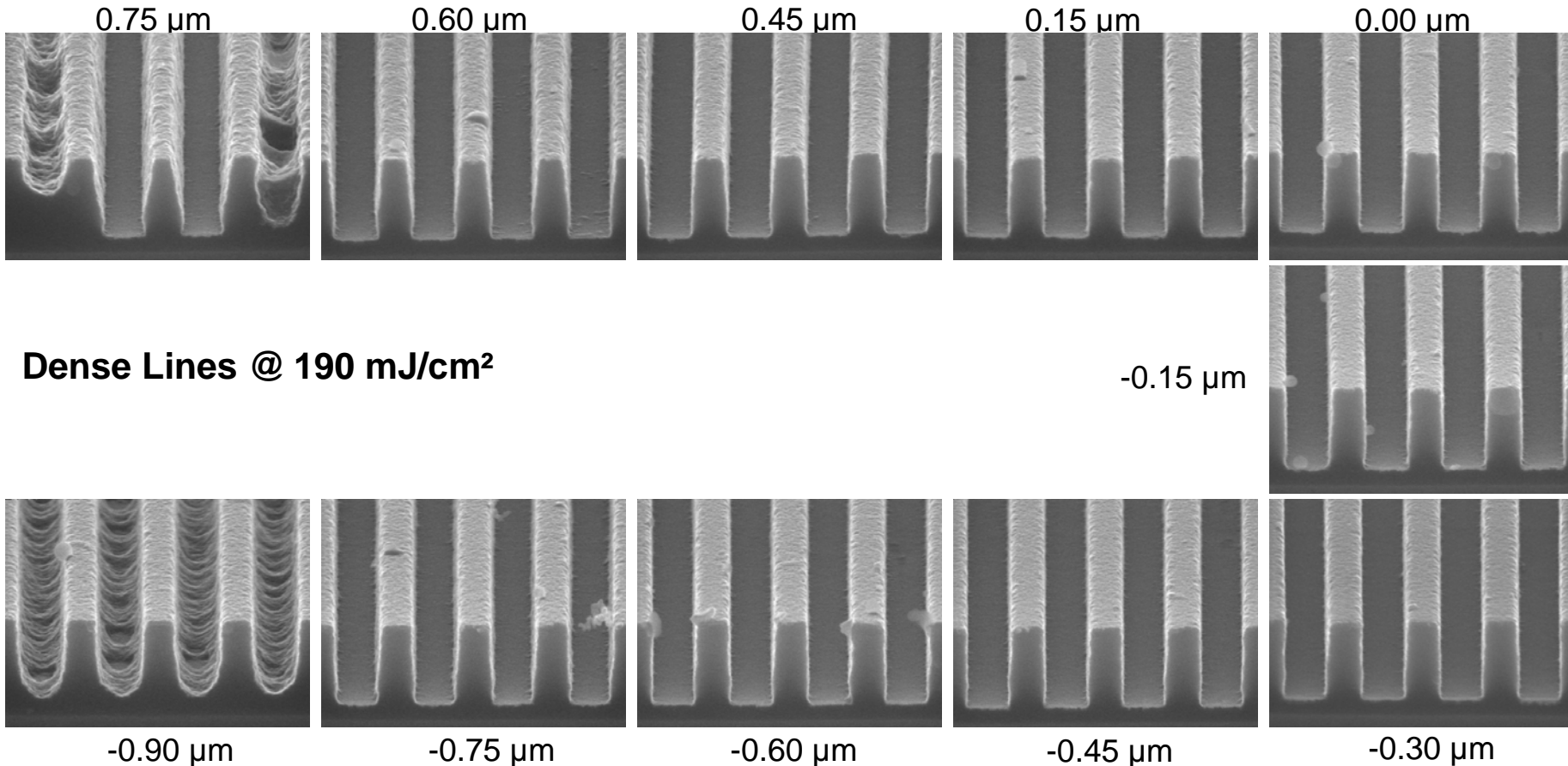
PEB: 110°C/90 sec proximity

0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C



# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.30μm



FT: 0.66μm on 1300Å AZ BARLi II Coating

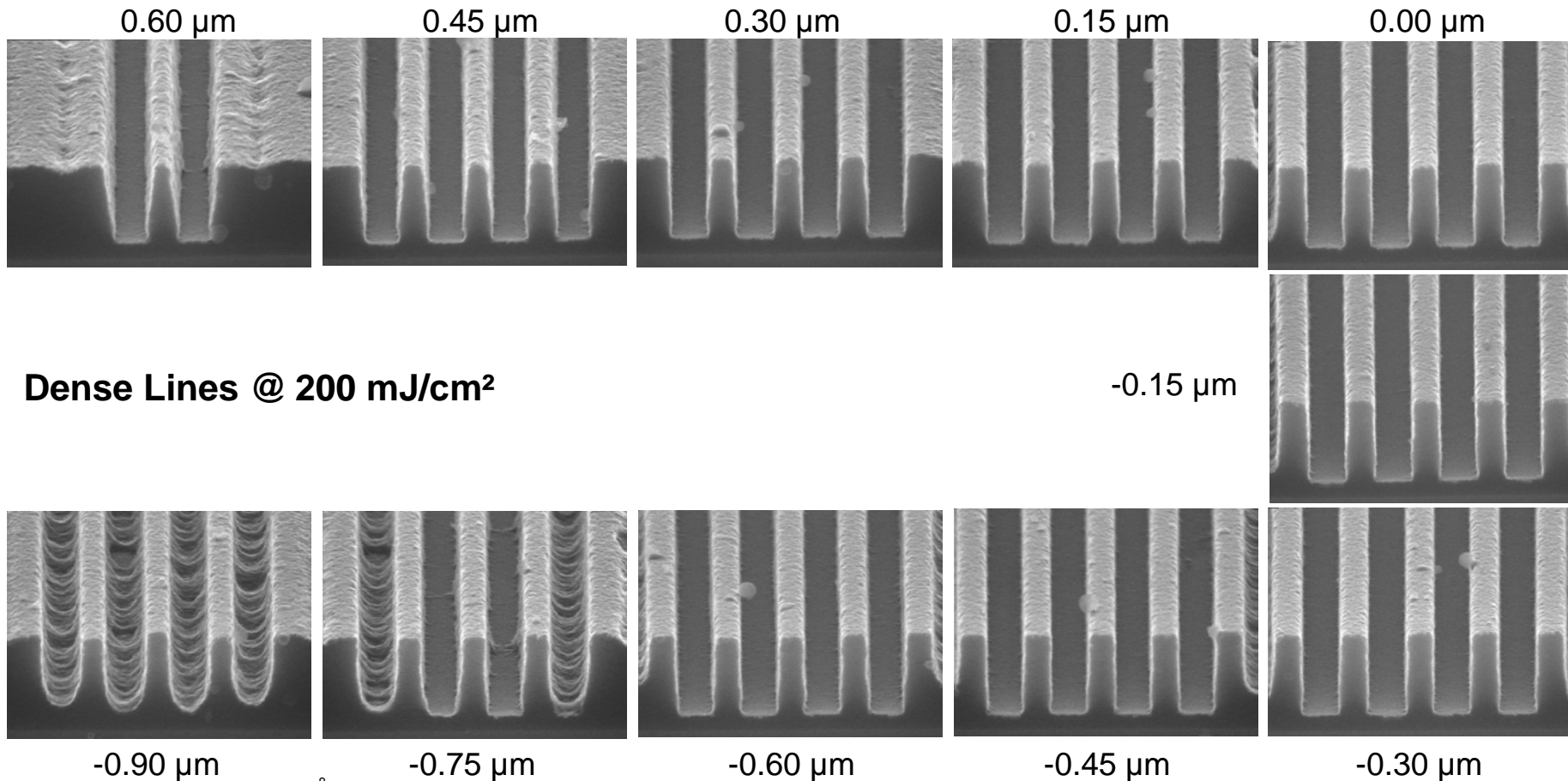
SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55

PEB: 110°C/90 sec proximity

0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.25 $\mu$ m



FT: 0.66 $\mu$ m on 1300Å AZ BARLi II Coating

SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55

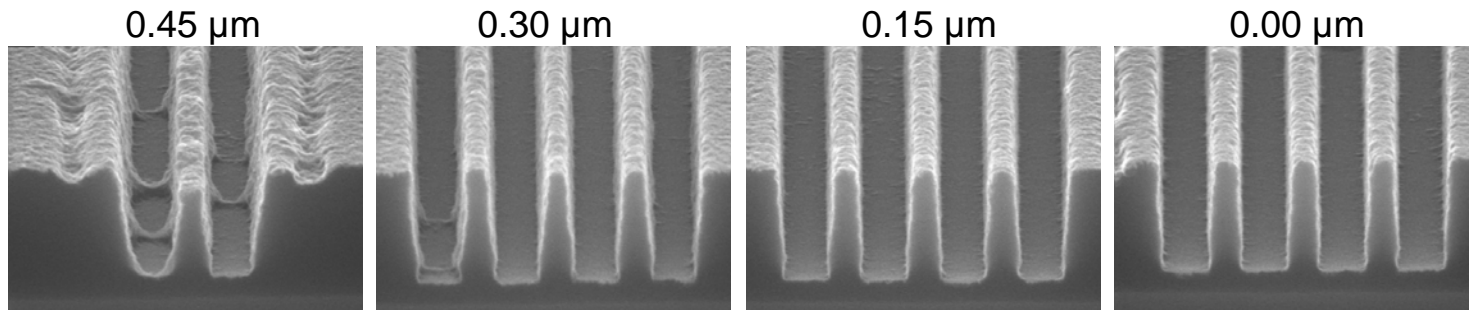
PEB: 110°C/90 sec proximity

0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C



# AZ HiR 1075 Photoresist

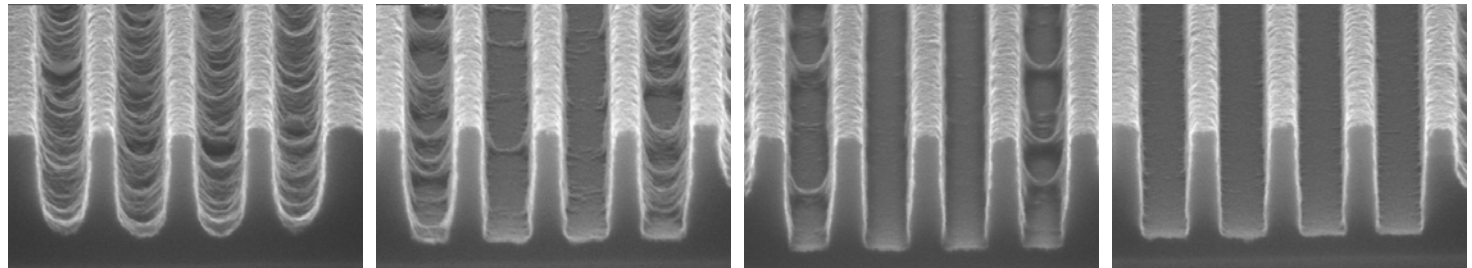
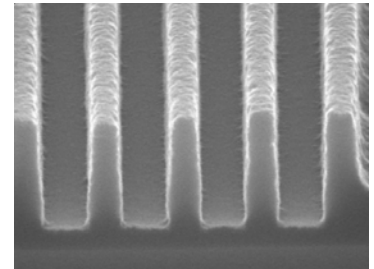
## Depth of Focus @ 0.22 $\mu$ m



Assumption :  
~0.7 $\mu$ m DOF  
@ 0.22 $\mu$ m dense l/s  
if using B.F. reticle

**Dense Lines @ 220 mJ/cm<sup>2</sup>**

-0.15  $\mu$ m



-0.75  $\mu$ m

-0.60  $\mu$ m

-0.45  $\mu$ m

-0.30  $\mu$ m

FT: 0.66 $\mu$ m on 1300 $\text{\AA}$  AZ BARLi II Coating

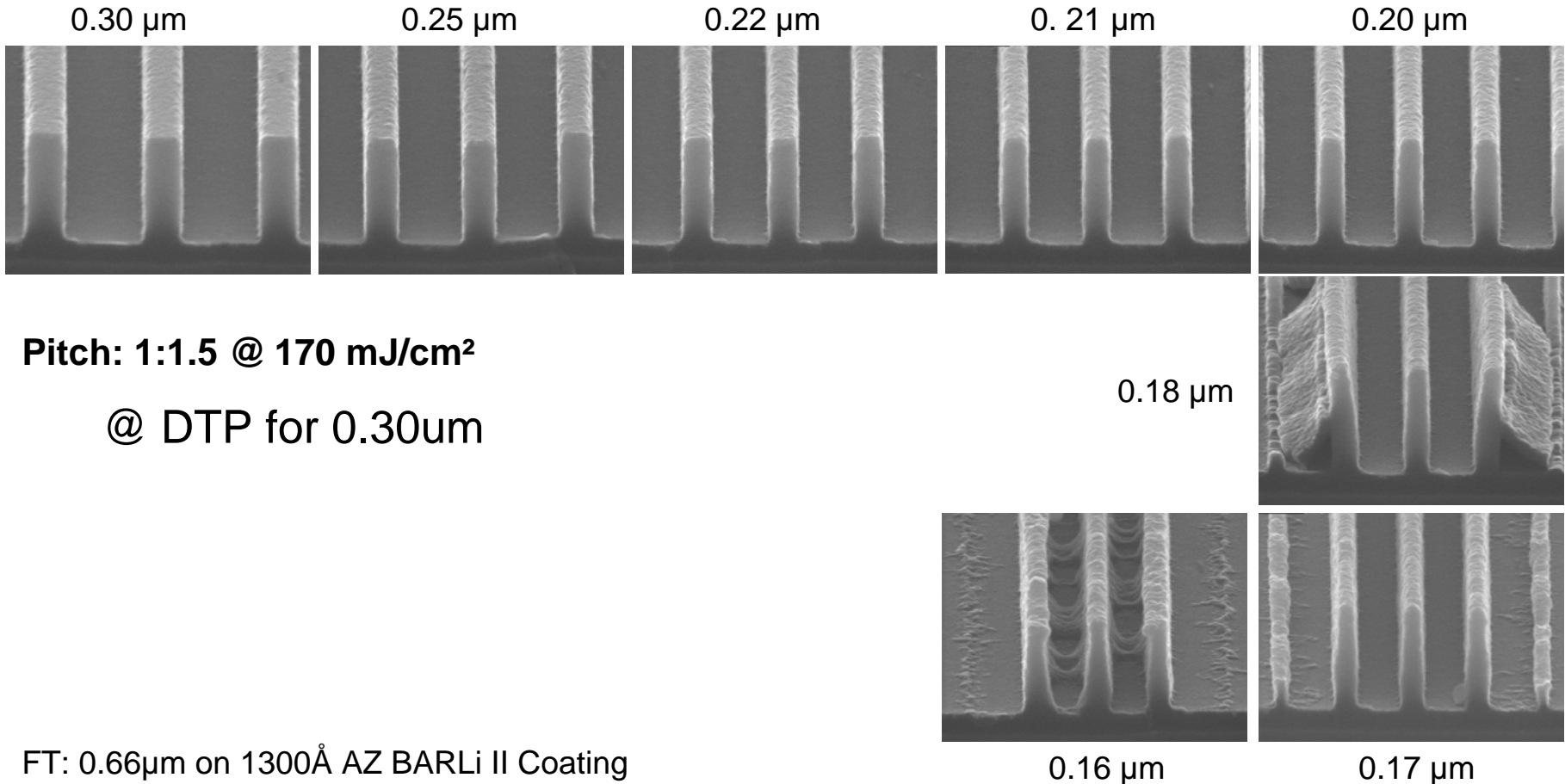
SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55

PEB: 110°C/90 sec proximity

2.38% TMAH Developer/ Single puddle for 60 sec at 21.0°C

# AZ HiR 1075 Photoresist

## Linearity / Resolution SEMs



FT: 0.66 $\mu\text{m}$  on 1300Å AZ BARLi II Coating

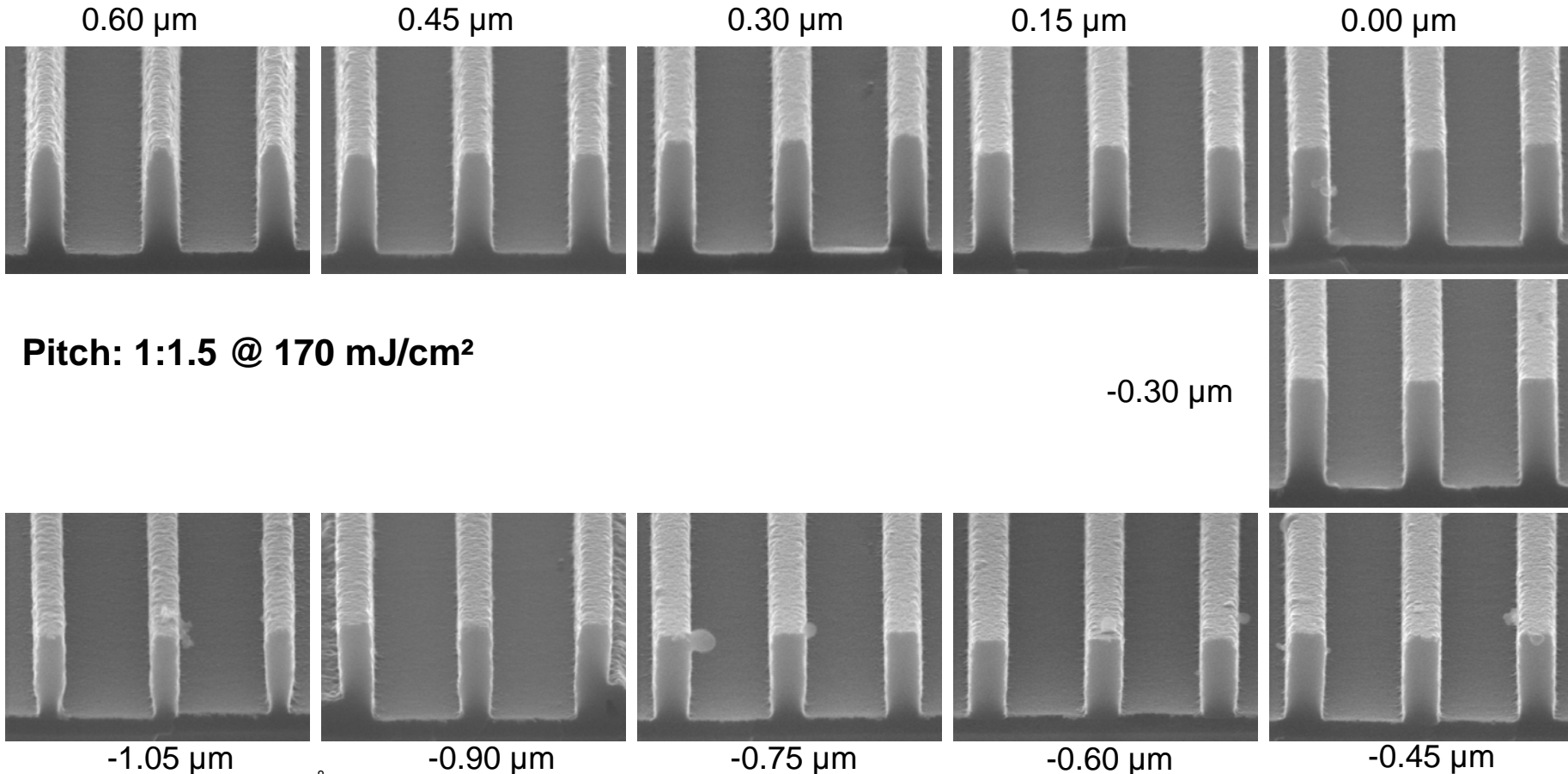
SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55

PEB: 110°C/90 sec proximity

0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.30 $\mu$ m



FT: 0.66 $\mu$ m on 1300Å AZ BARLi II Coating

SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55

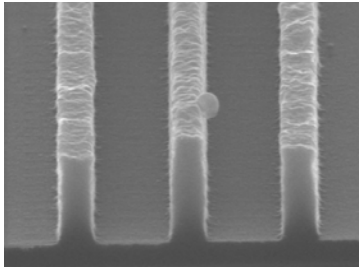
PEB: 110°C/90 sec proximity

0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

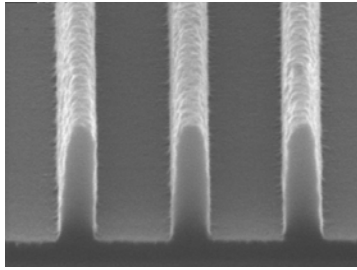
# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.25 $\mu$ m

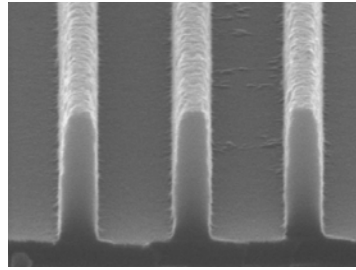
0.60  $\mu$ m



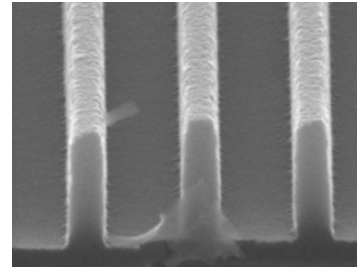
0.45  $\mu$ m



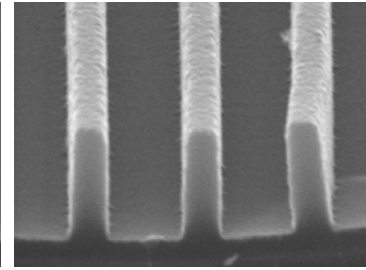
0.30  $\mu$ m



0.15  $\mu$ m

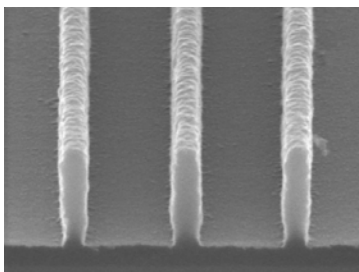
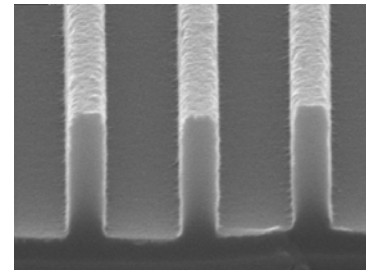


0.00  $\mu$ m

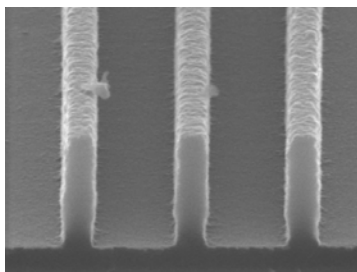


Pitch: 1:1.5 @ 170 mJ/cm<sup>2</sup>

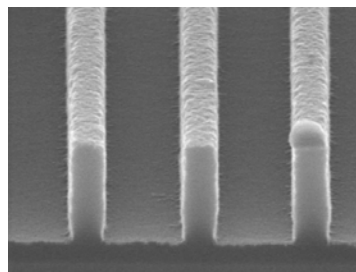
-0.30  $\mu$ m



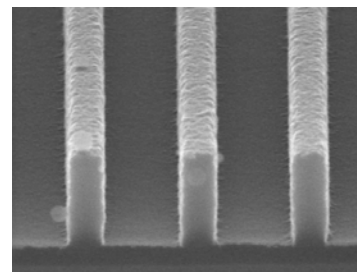
-1.05  $\mu$ m



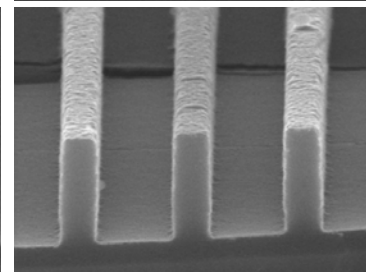
-0.90  $\mu$ m



-0.75  $\mu$ m



-0.60  $\mu$ m



-0.45  $\mu$ m

FT: 0.66 $\mu$ m on 1300Å AZ BARLi II Coating

SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55

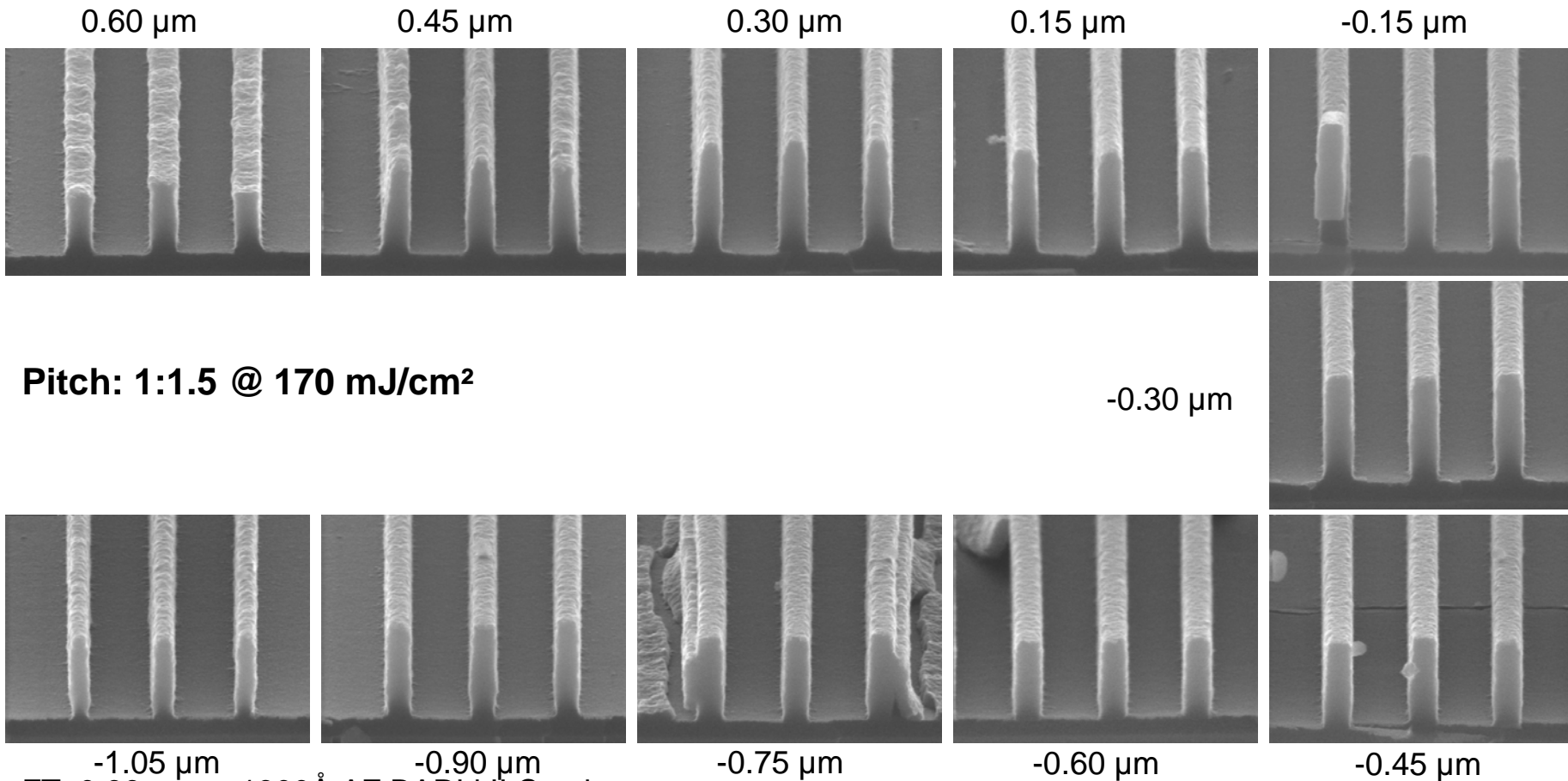
PEB: 110°C/90 sec proximity

0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C



# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.22 $\mu$ m



FT: 0.66 $\mu$ m on 1300Å AZ BARLi II Coating

SB: 90°C/60 sec proximity, Annular NA: 0.65 Sigma Outer/Inner: 0.85/0.55

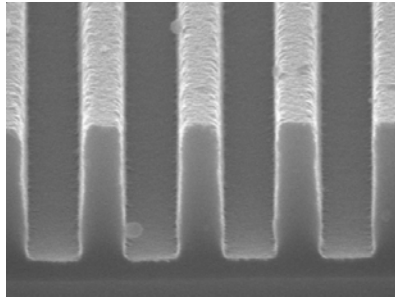
PEB: 110°C/90 sec proximity

0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

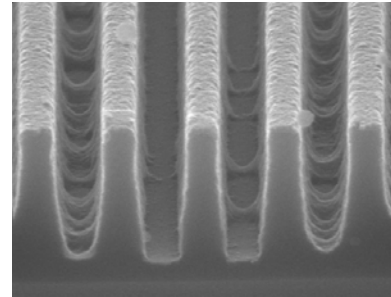
# AZ HiR 1075 Photoresist

## Linearity / Resolution SEMs

0.30  $\mu\text{m}$



0.25  $\mu\text{m}$



**Dense Lines @ 215 mJ/cm<sup>2</sup>**

@ DTP for 0.30 $\mu\text{m}$  l/s  
- darkfield reticle

FT: 0.88 $\mu\text{m}$  on 1300Å AZ BARLi II Coating

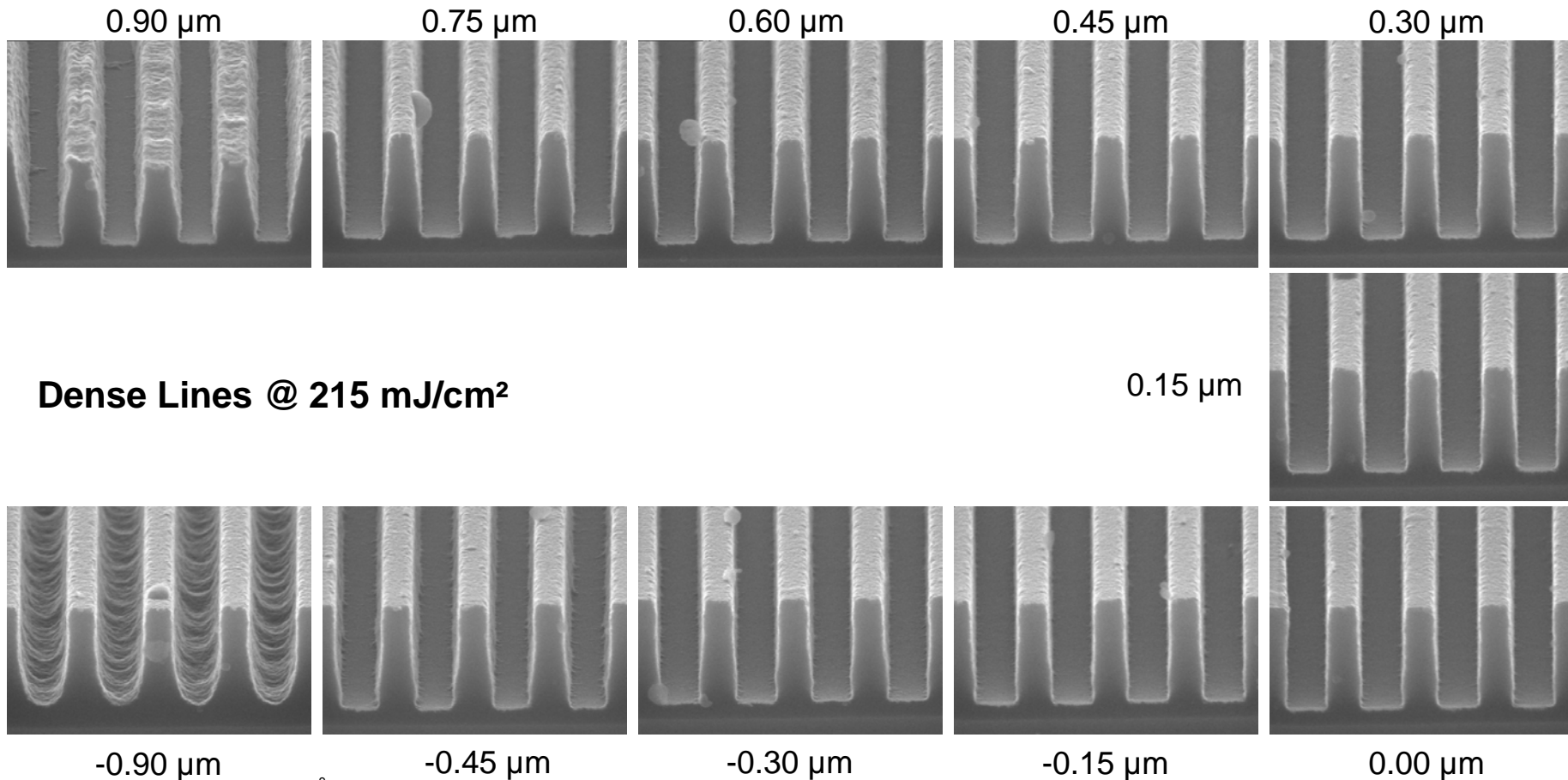
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85

PEB: 110°C/90 sec proximity

0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.30 $\mu$ m



FT: 0.88 $\mu$ m on 1300Å AZ BARLi II Coating

SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85

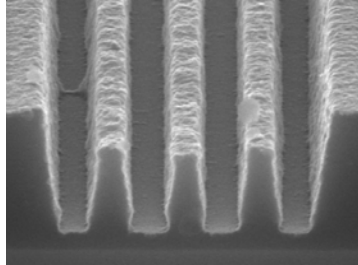
PEB: 110°C/90 sec proximity

0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

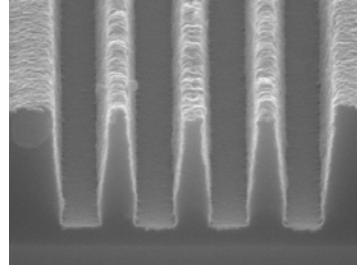
# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.25 $\mu$ m

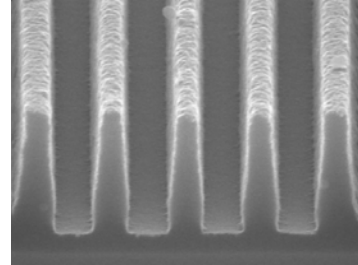
0.75  $\mu$ m



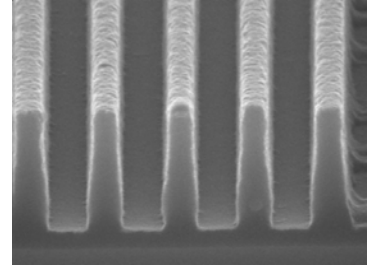
0.60  $\mu$ m



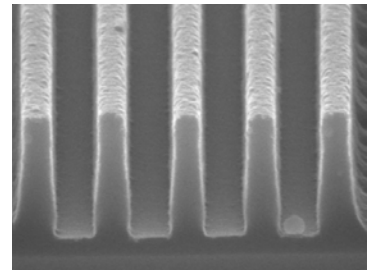
0.45  $\mu$ m



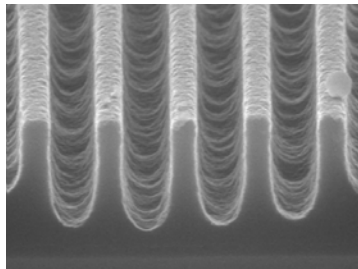
0.30  $\mu$ m



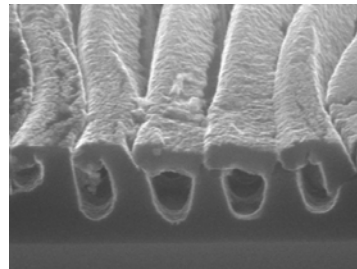
0.15  $\mu$ m



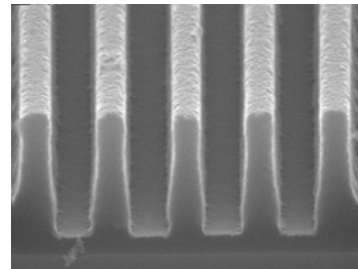
**Dense Lines @ 230 mJ/cm<sup>2</sup>**



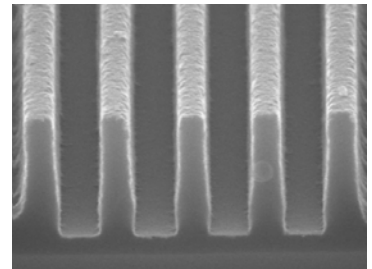
-0.45  $\mu$ m



-0.30  $\mu$ m



-0.15  $\mu$ m



0.00  $\mu$ m

FT: 0.88 $\mu$ m on 1300Å AZ BARLi II Coating

SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85

PEB: 110°C/90 sec proximity

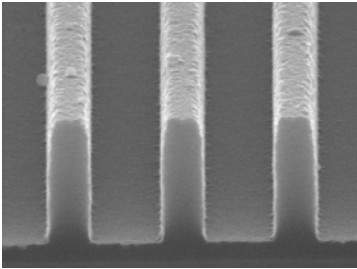
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C



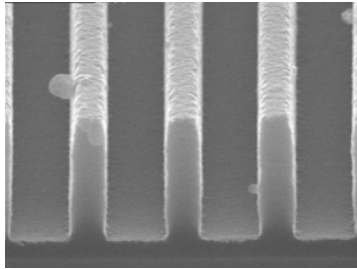
# AZ HiR 1075 Photoresist

## Linearity / Resolution SEMs

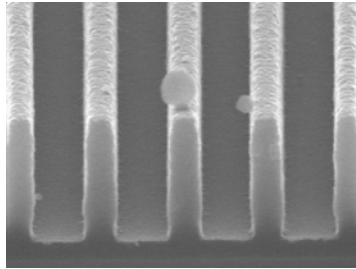
0.30  $\mu\text{m}$



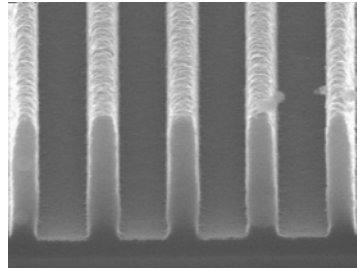
0.25  $\mu\text{m}$



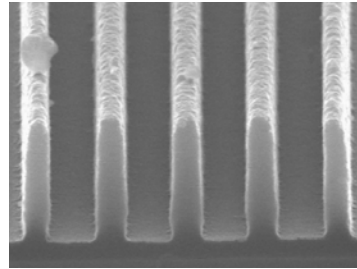
0.22  $\mu\text{m}$



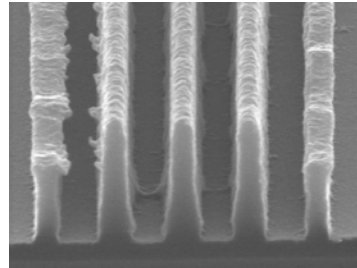
0.21  $\mu\text{m}$



0.20  $\mu\text{m}$



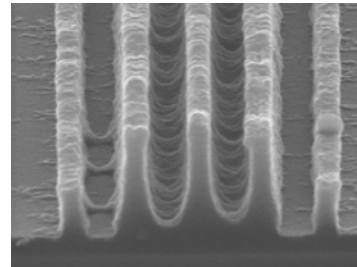
0.18  $\mu\text{m}$



**Pitch: 1:1.5 @ 185 mJ/cm<sup>2</sup>**

**@ DTP for 0.30 $\mu\text{m}$**

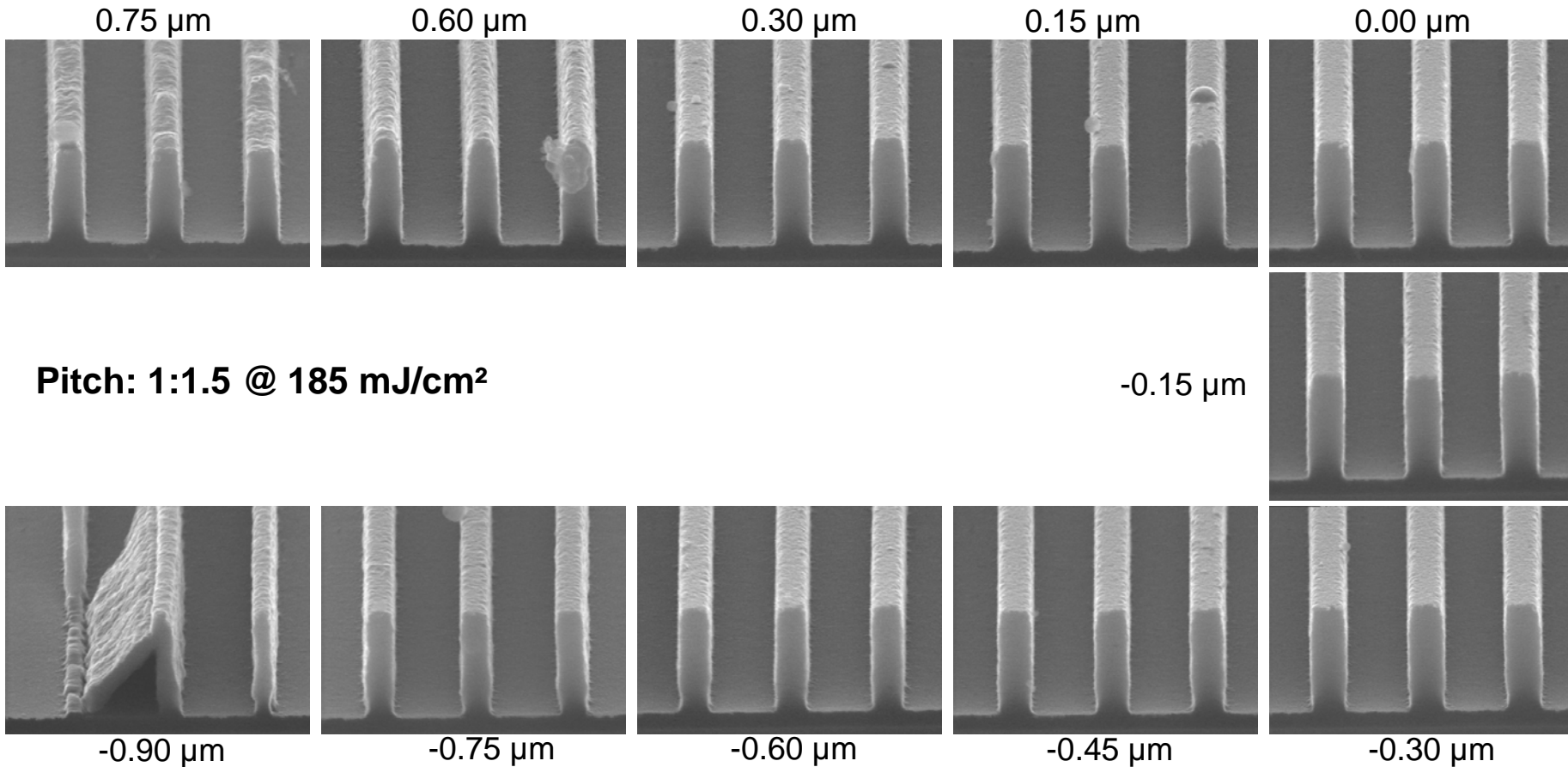
0.17  $\mu\text{m}$



FT: 0.88 $\mu\text{m}$  on 1300Å AZ BARLi II Coating  
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85  
PEB: 110°C/90 sec proximity  
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.30 $\mu$ m



FT: 0.88 $\mu$ m on 1300 $\text{\AA}$  AZ BARLi II Coating

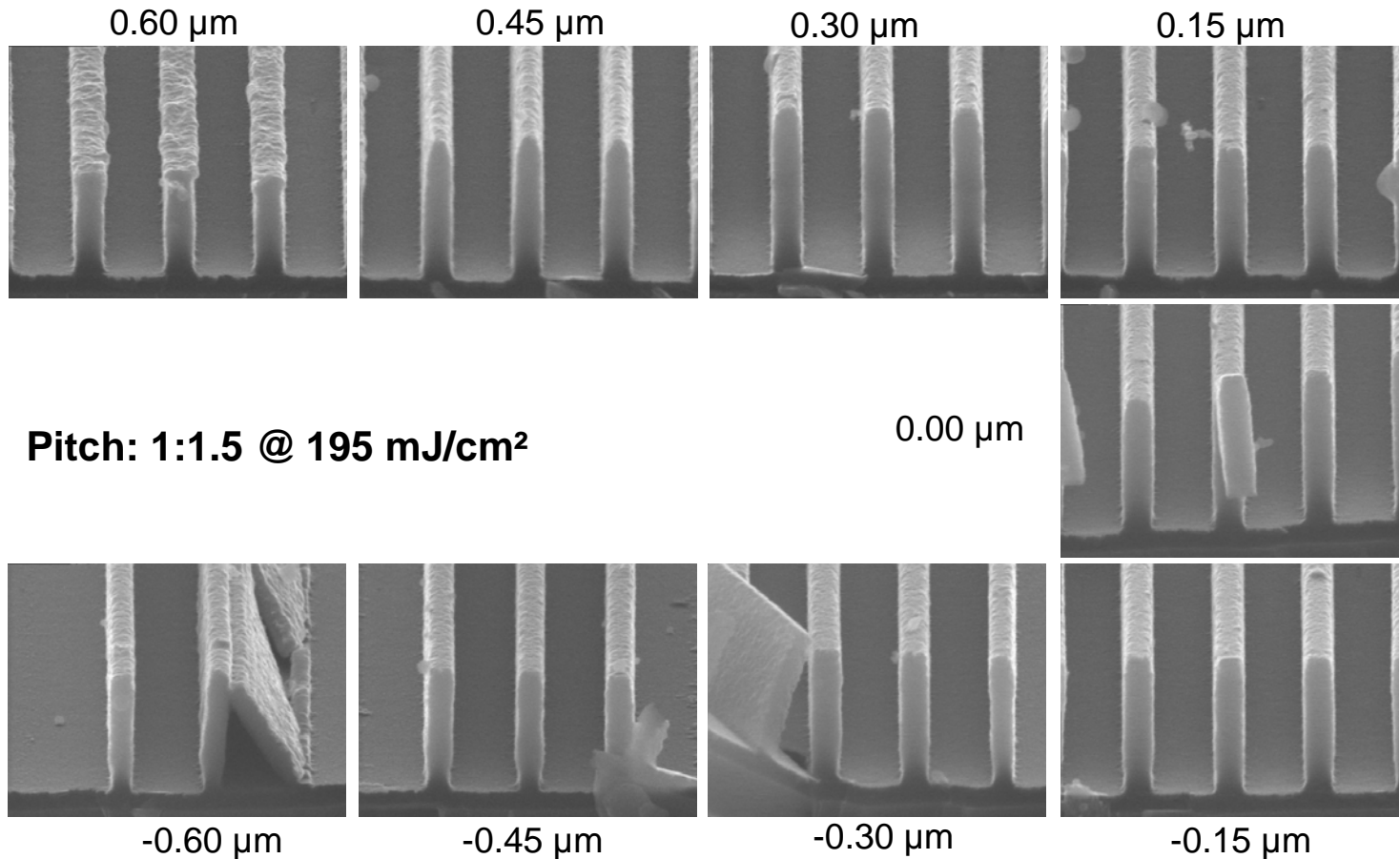
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85

PEB: 110°C/90 sec proximity

0.238 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.25 $\mu$ m



FT: 0.88 $\mu$ m on 1300Å AZ BARLi II Coating

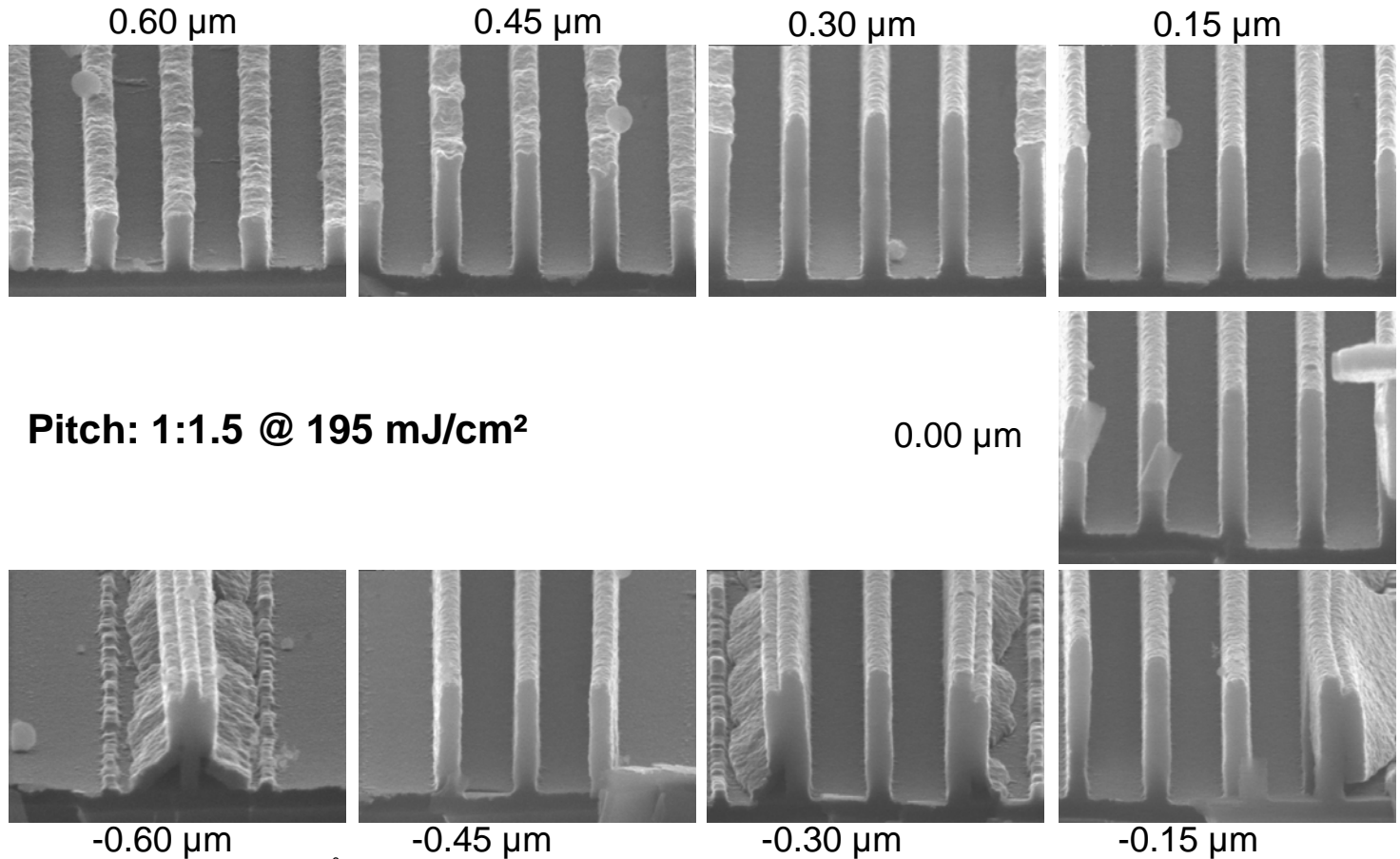
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85

PEB: 110°C/90 sec proximity

0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.22 $\mu$ m



FT: 0.88 $\mu$ m on 1300Å AZ BARLi II Coating

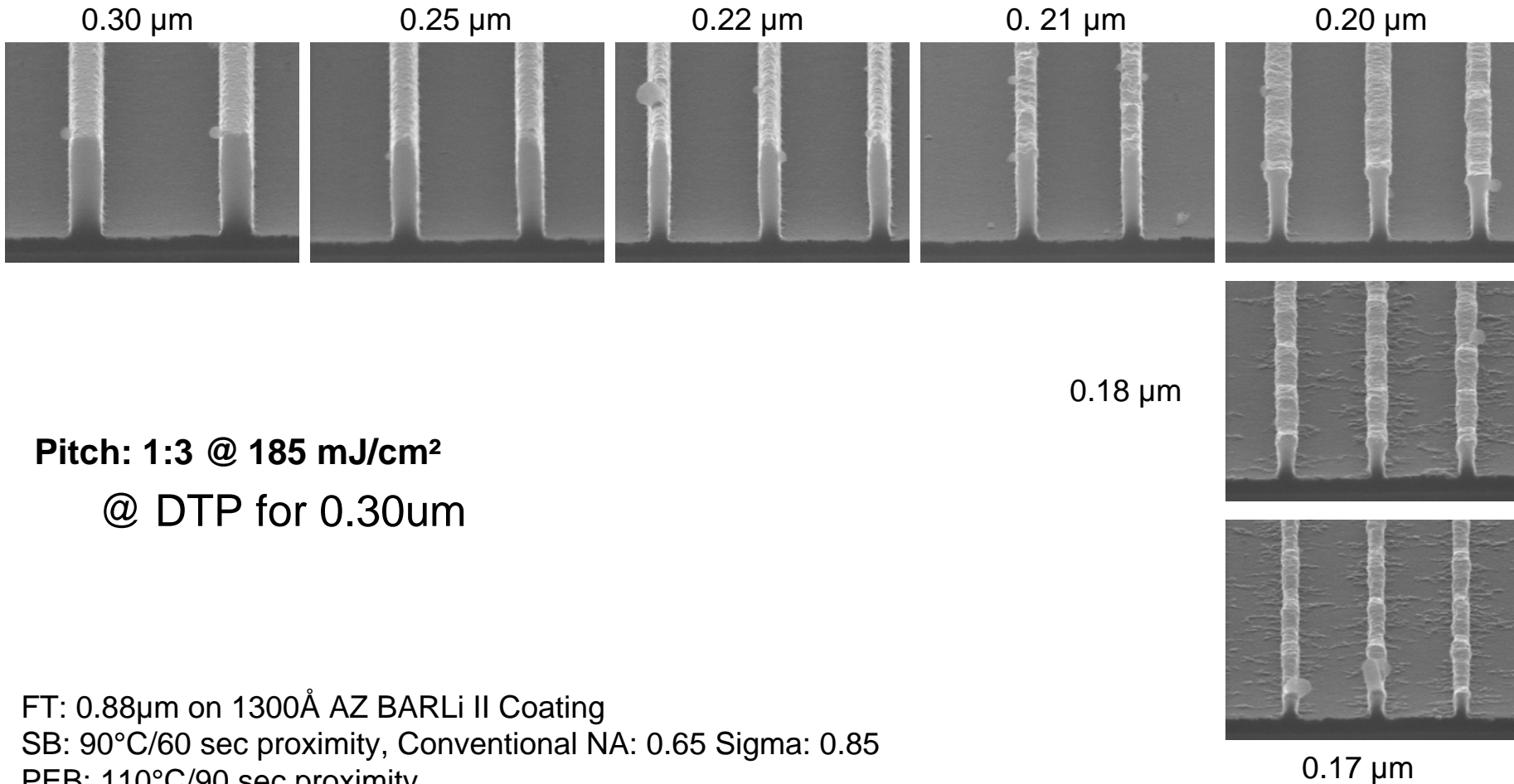
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85

PEB: 110°C/90 sec proximity

0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

# AZ HiR 1075 Photoresist

## Linearity / Resolution SEMs

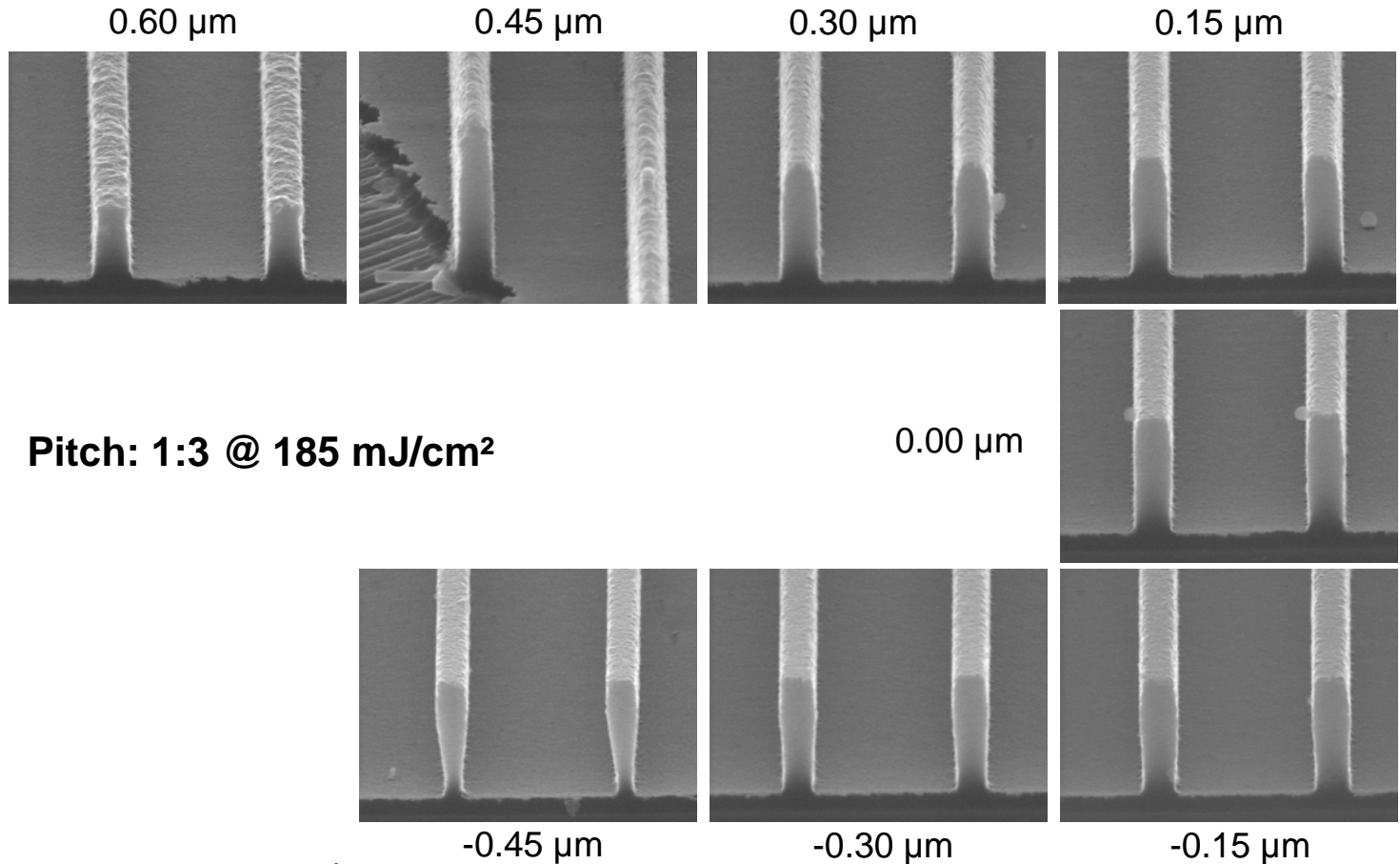


FT: 0.88 $\mu\text{m}$  on 1300Å AZ BARLi II Coating  
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85  
PEB: 110°C/90 sec proximity  
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C



# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.30 $\mu$ m



FT: 0.88 $\mu$ m on 1300 $\text{\AA}$  AZ BARLi II Coating

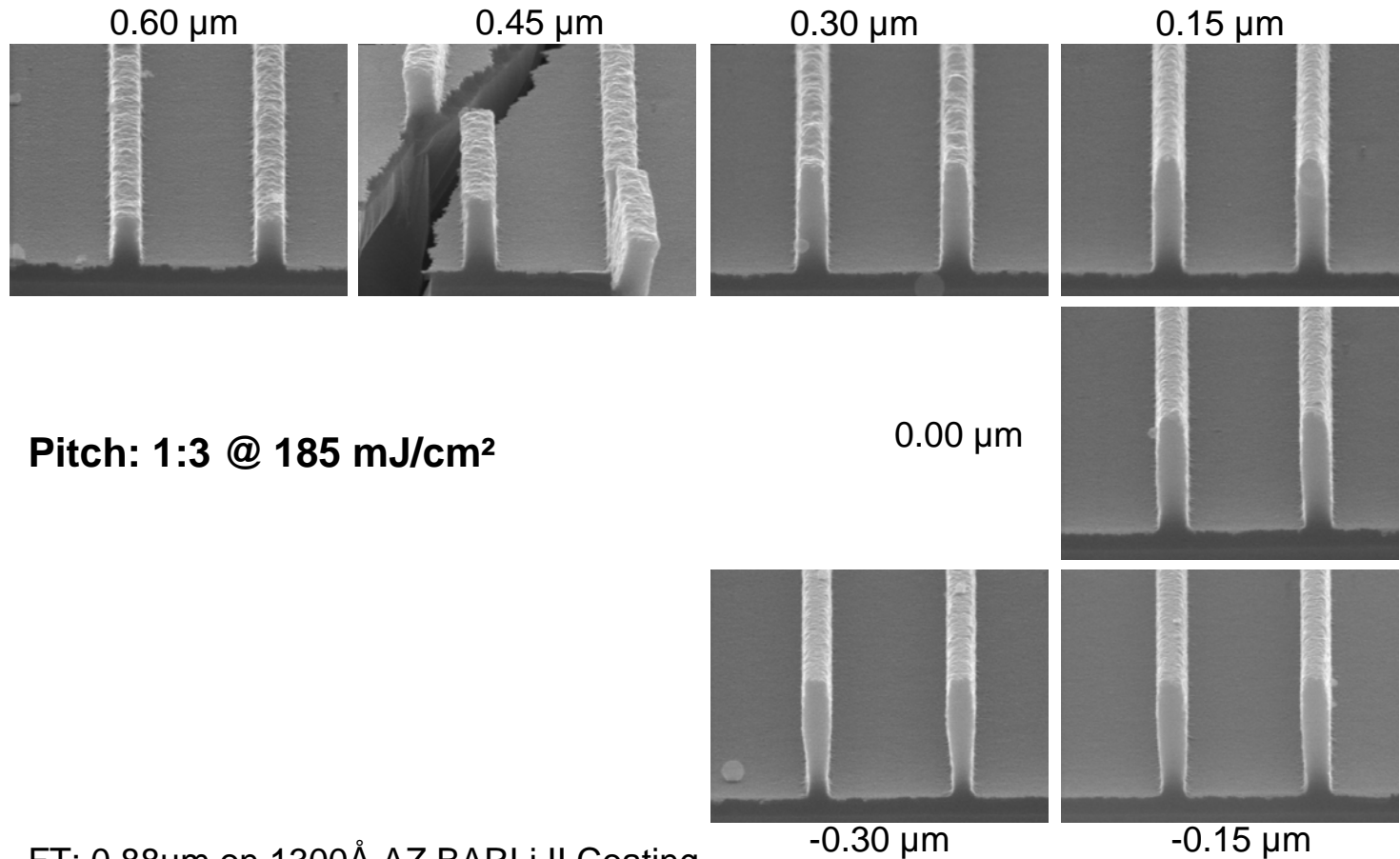
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85

PEB: 110°C/90 sec proximity

0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C

# AZ HiR 1075 Photoresist

## Depth of Focus @ 0.25 $\mu$ m



FT: 0.88 $\mu$ m on 1300Å AZ BARLi II Coating  
SB: 90°C/60 sec proximity, Conventional NA: 0.65 Sigma: 0.85  
PEB: 110°C/90 sec proximity  
0.261 N TMAH Developer/ Single puddle for 60 sec at 21.0°C