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The training of SU80X0

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1. Accelerating Voltage & WD

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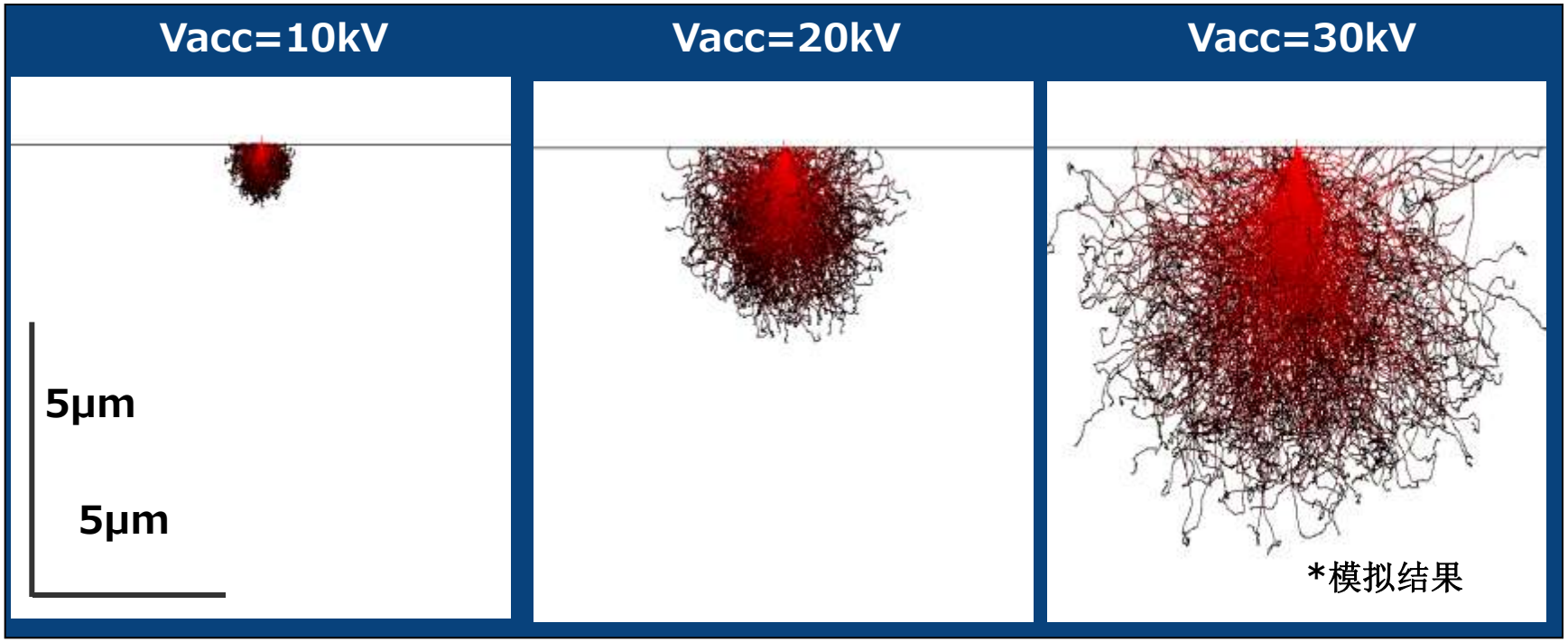
The scattered area change according to Vacc.



1. Accelerating Voltage & WD

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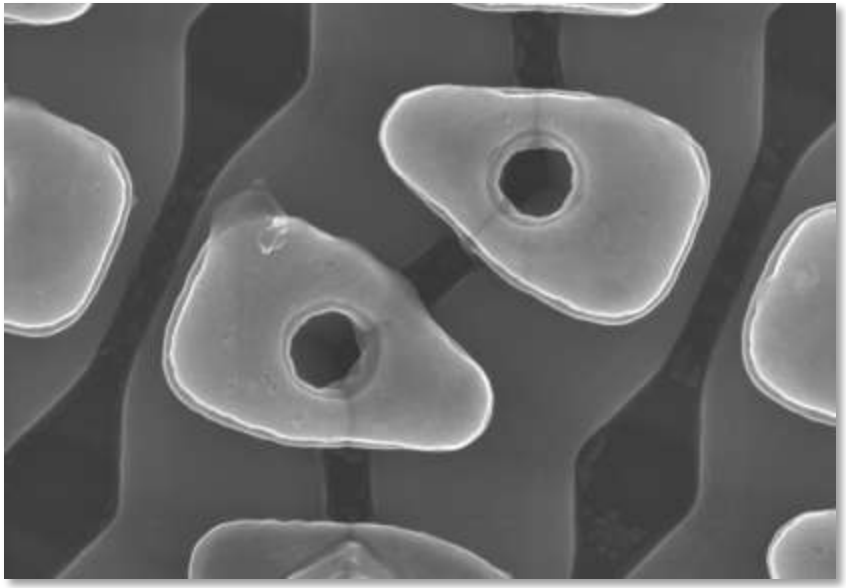
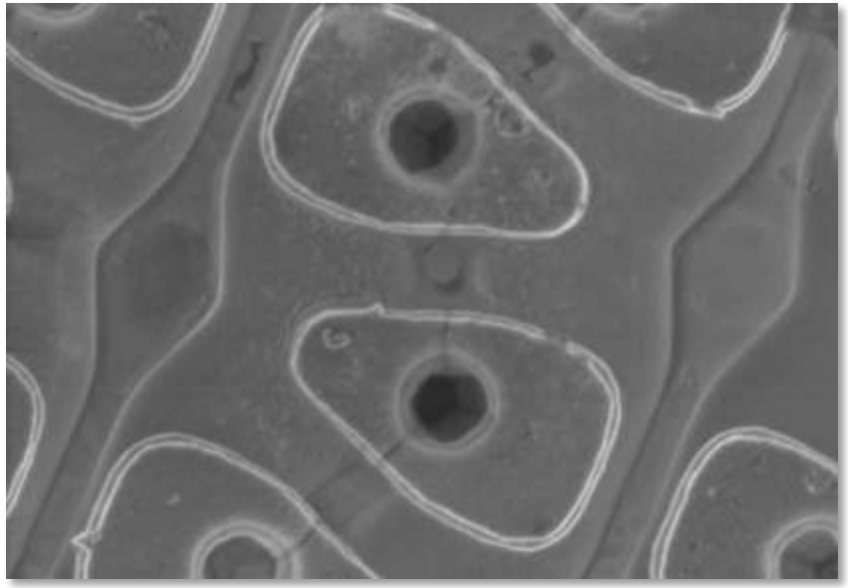
The relationship of Vacc and Image quality

Vacc=15kv



Internal information

Vacc=1kv



Surface information

- the information source change

Sample：16MDRAM

1. Accelerating Voltage & WD

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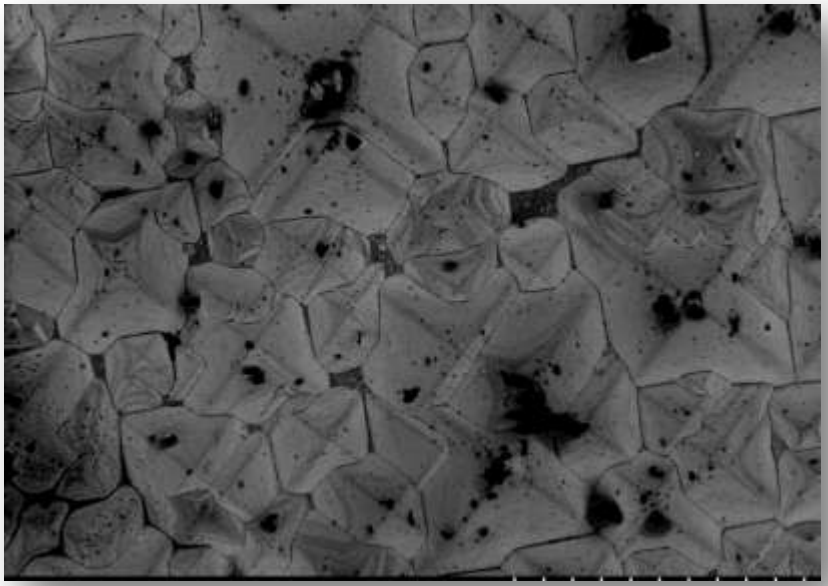
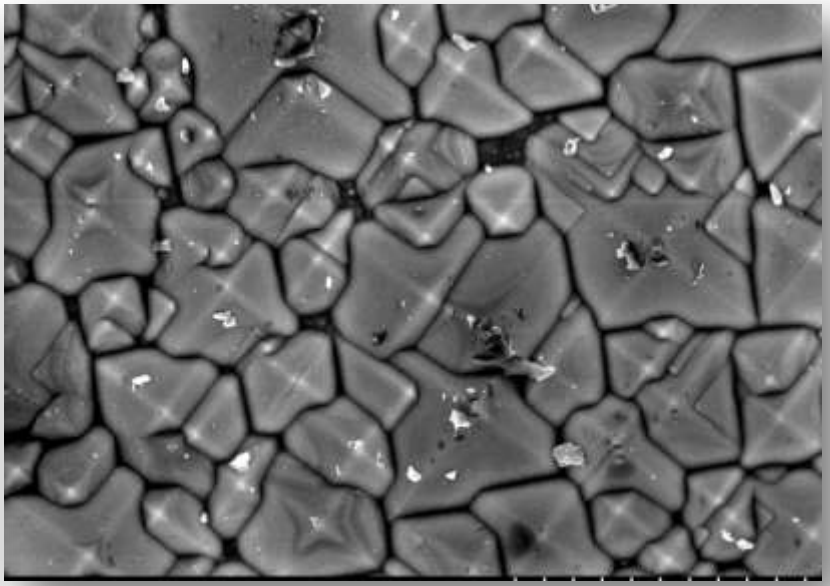
Different Vacc Upper detector (1)



Vacc=1.0kV



Vacc=15kV

Sample：Solar cell

1. Accelerating Voltage & WD

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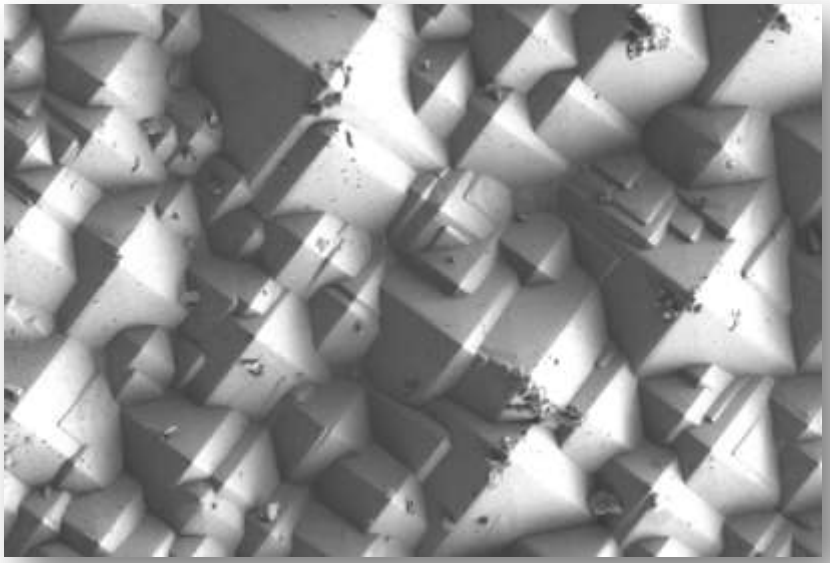
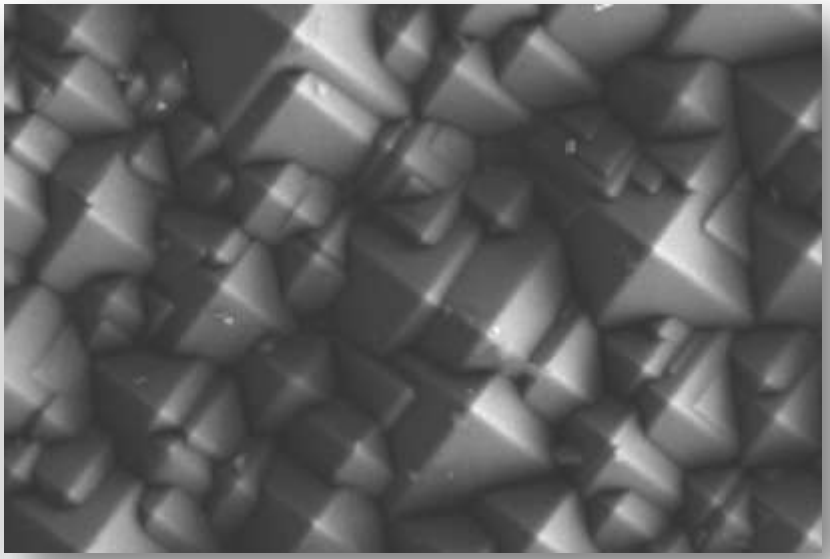
Different Vacc Lower detector (2)



Vacc=1.0kV



Vacc=15kV

1. Accelerating Voltage & WD

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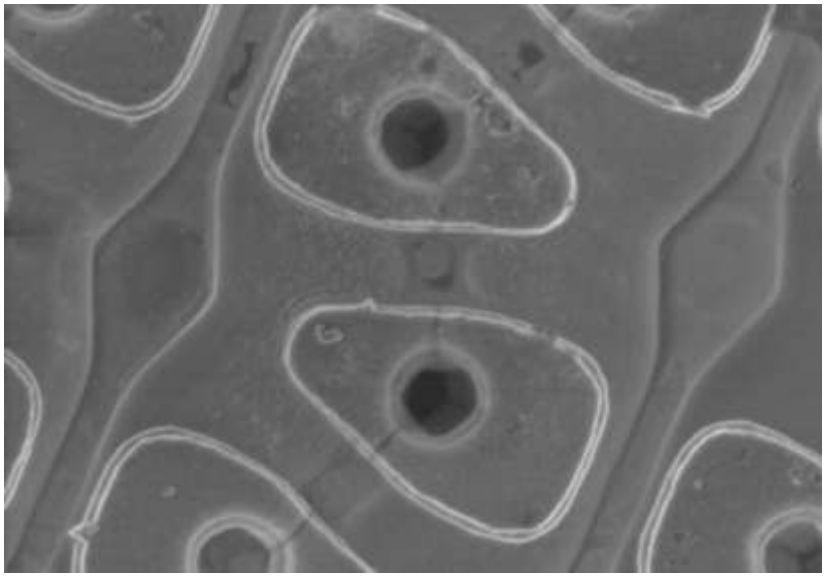
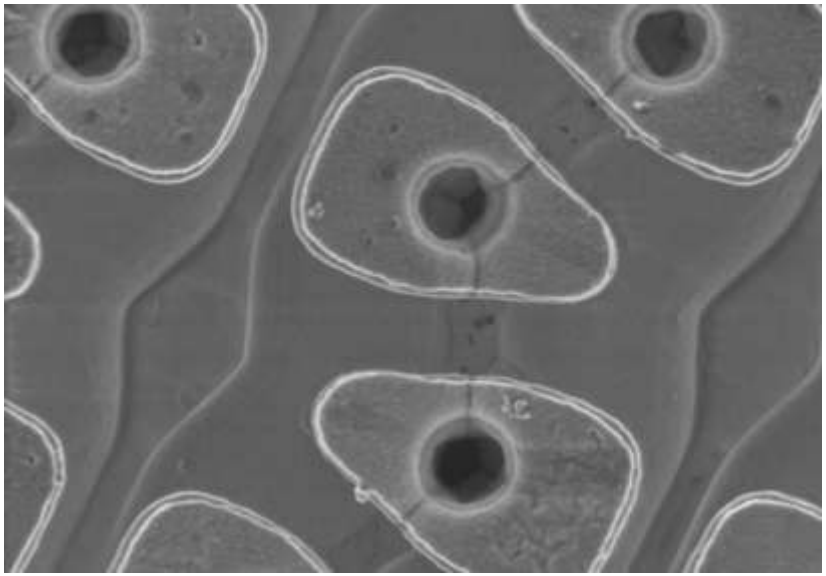
How to get high resolution at low Vacc?



WD=8.3mm



WD=2.3mm

- * shorten WD

Sample : 16MDRAM

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2. Upper & Lower Detector

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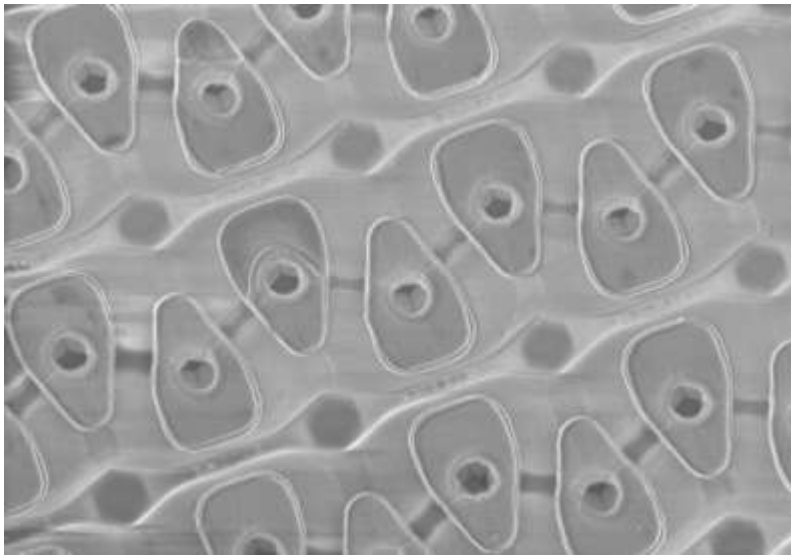
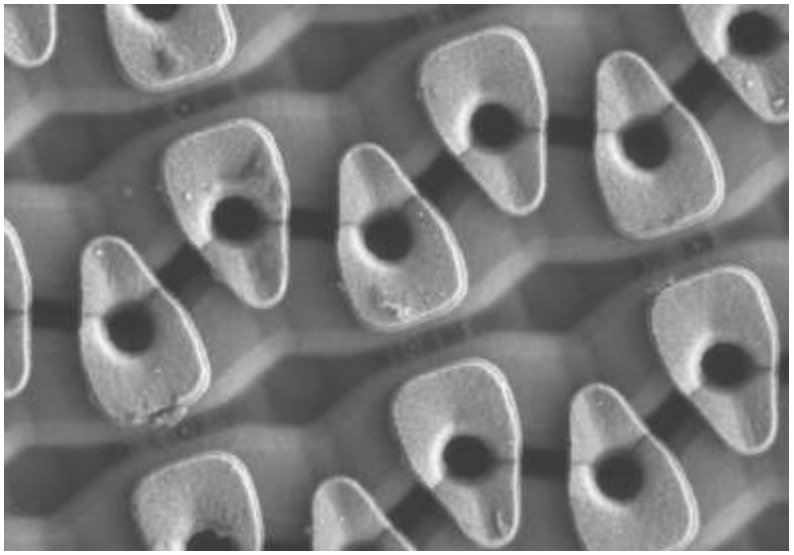
The Detector （Upper/Lower） (1)

Upper Detector



Lower Detector



・surface feature

・topography

Sample：16MDRAM

2. Upper & Lower Detector

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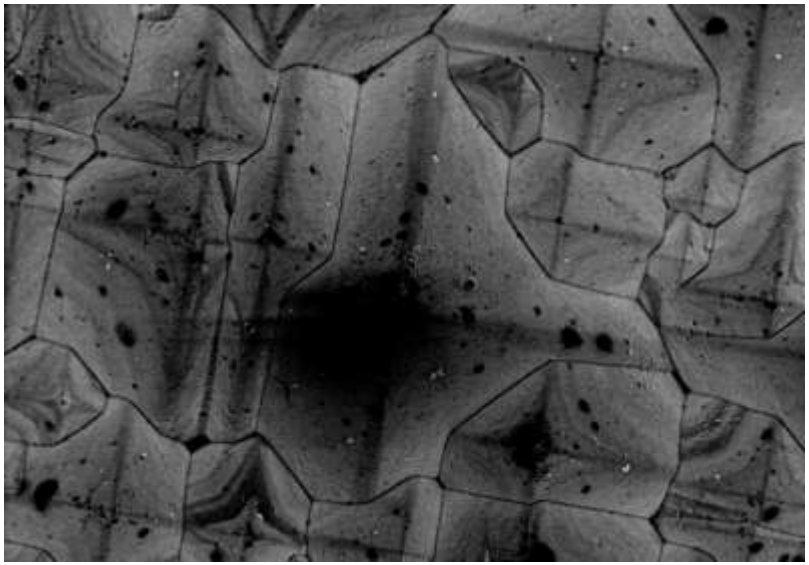
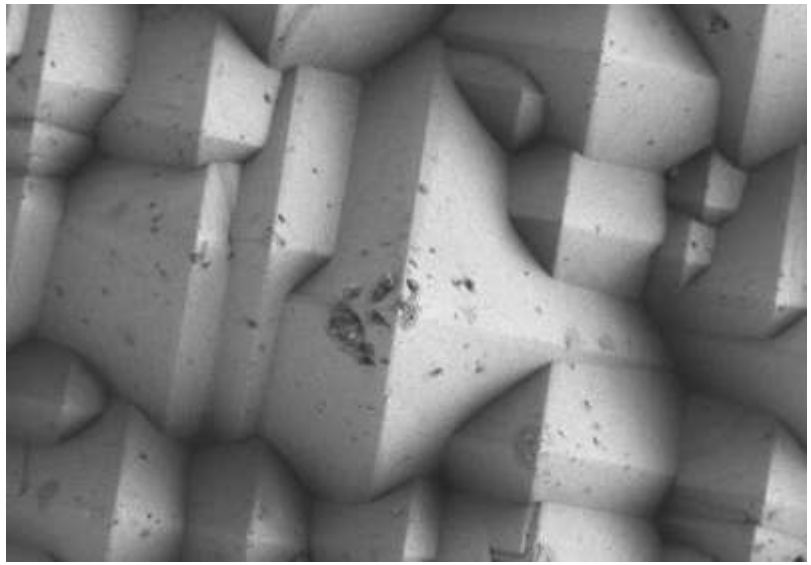
The Detector （Upper/Lower） (2)

Upper Detector



・surface feature

Lower Detector



・topography

■Sample：solar battery

2. Upper & Lower Detector

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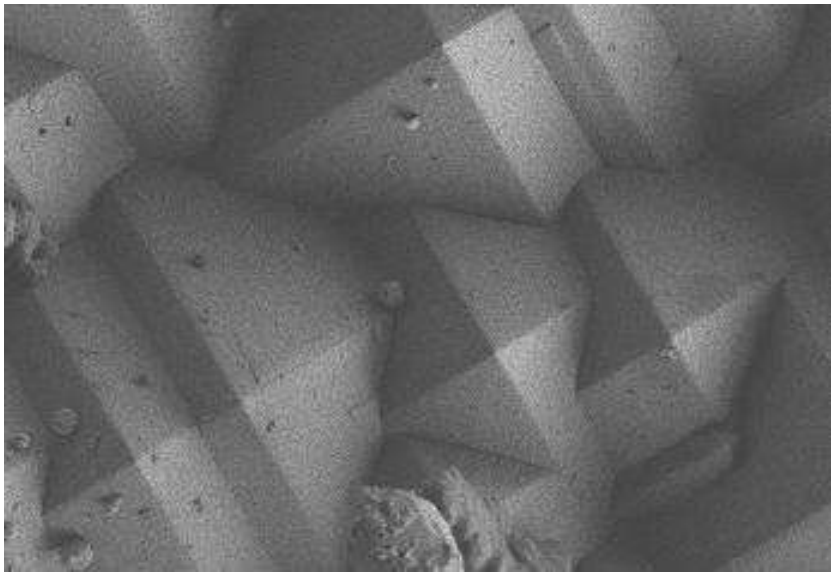
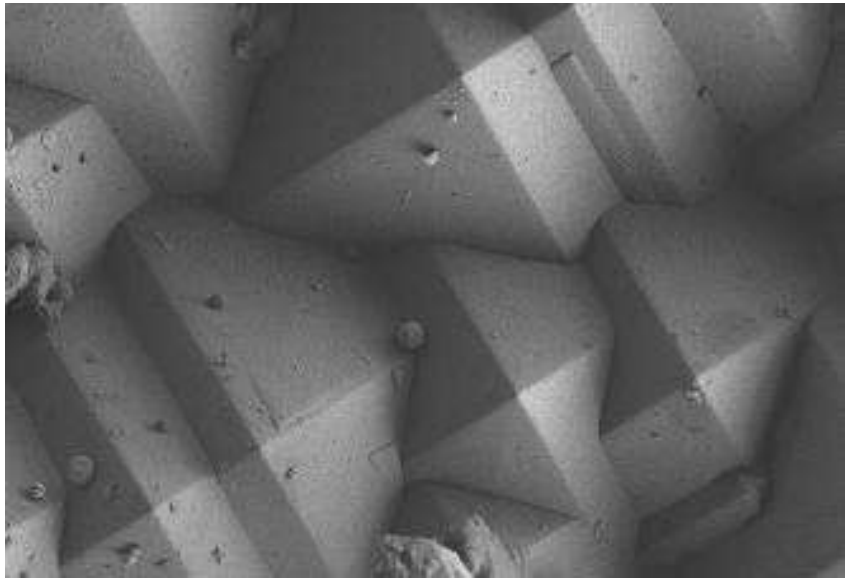
How to get clear image by Lower detector?



Normal mode



High mode

- Change the Probe Current to High mode.

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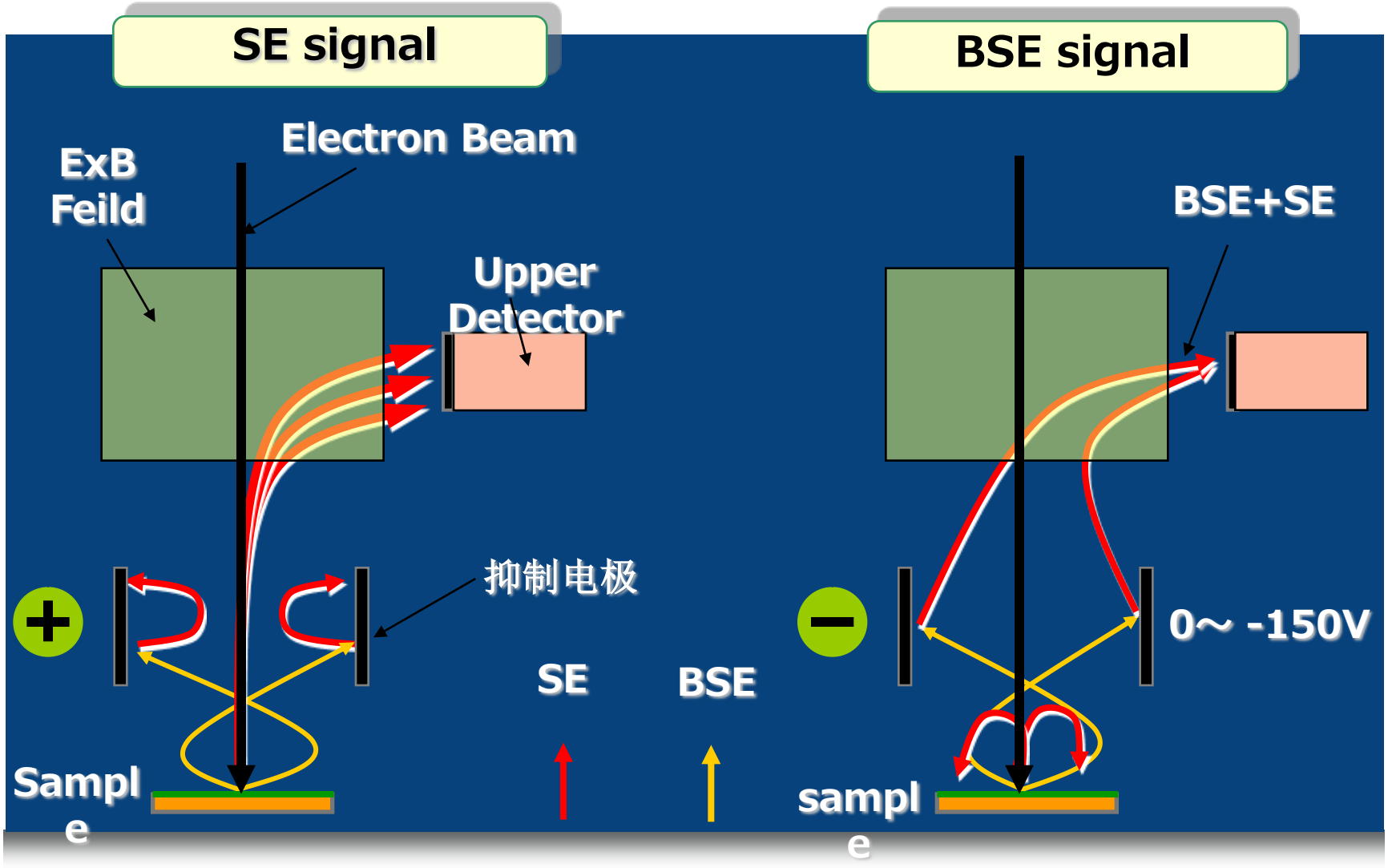
Super ExB



3. Super ExB

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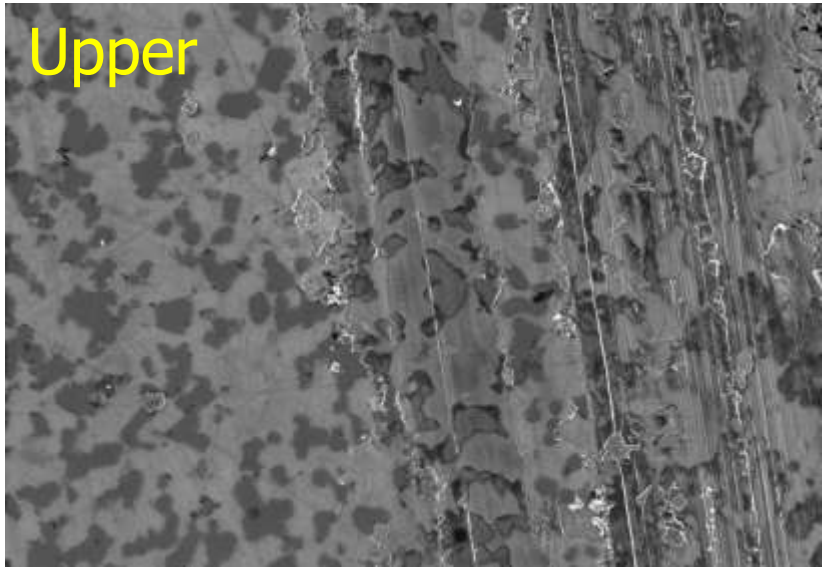

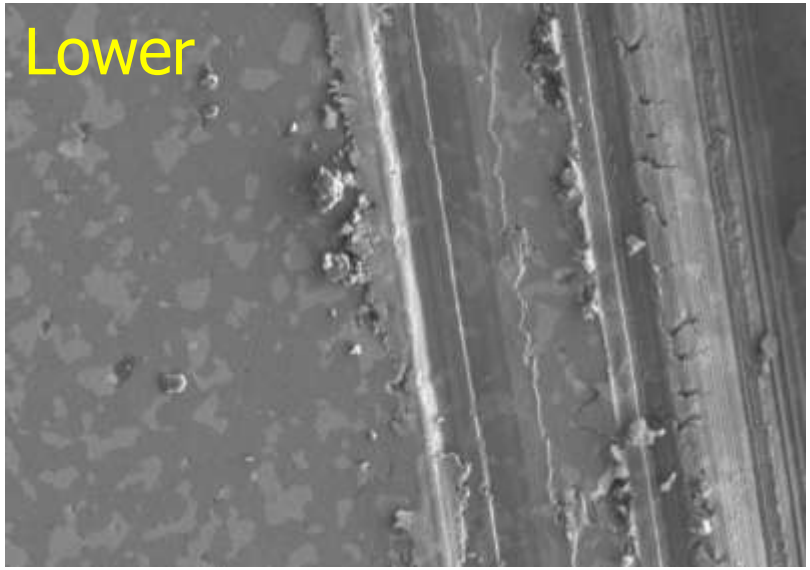

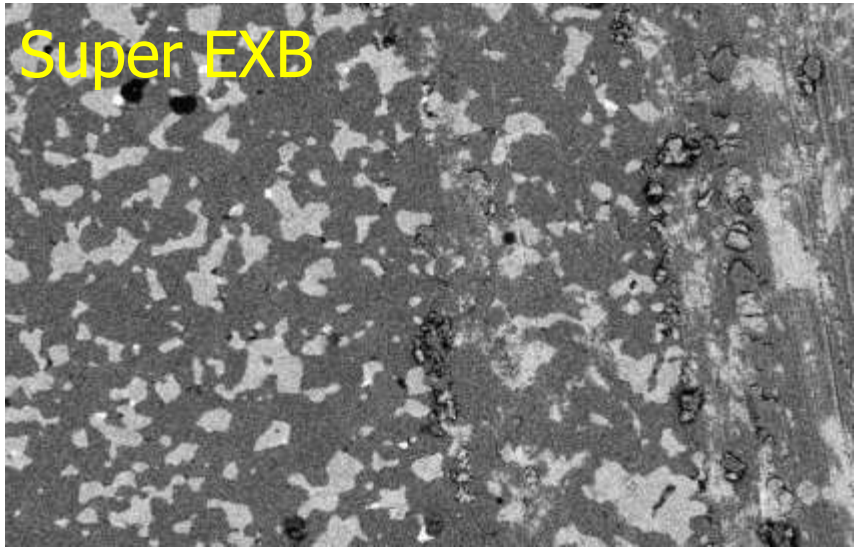

3. Super ExB

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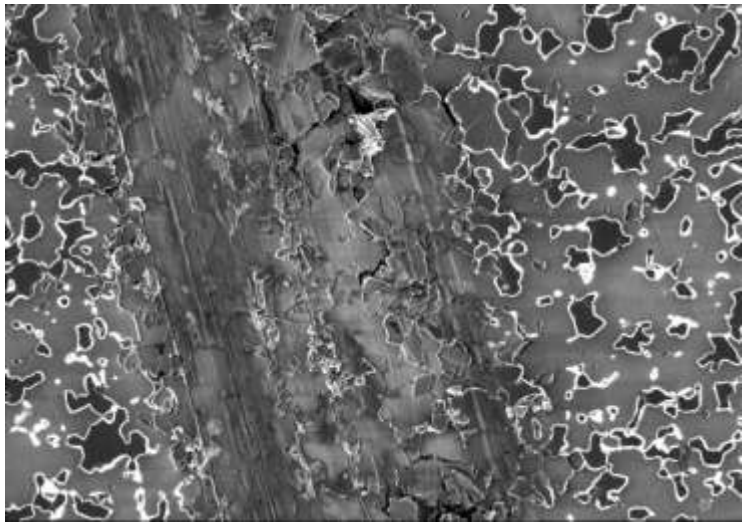
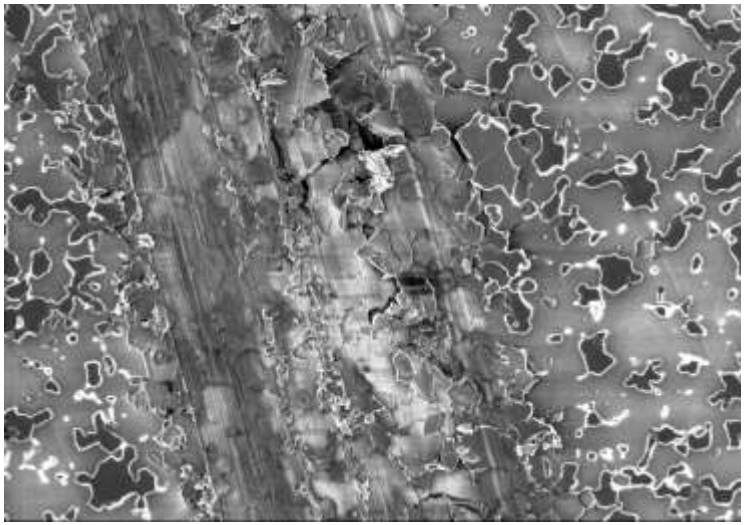
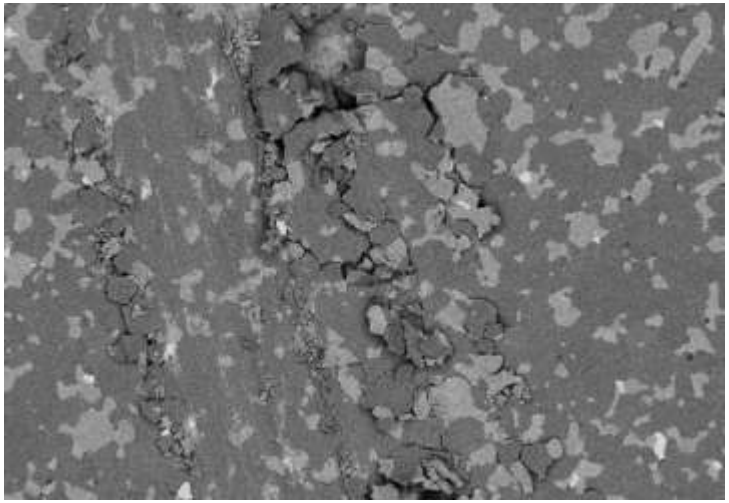


SE(U)

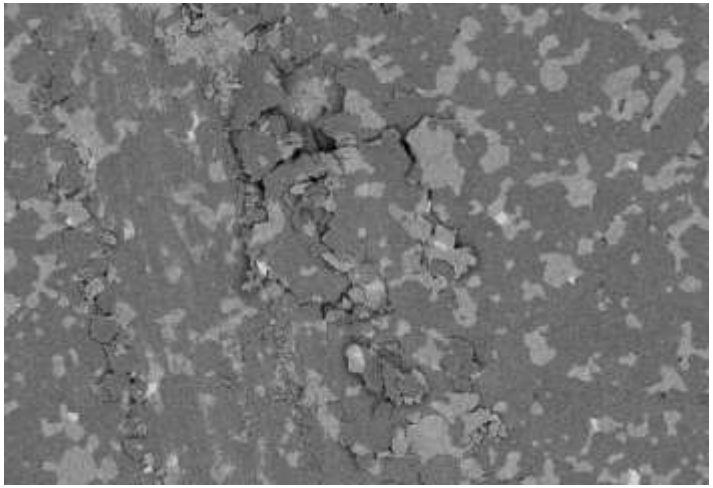
≈



SE(U,LA0)

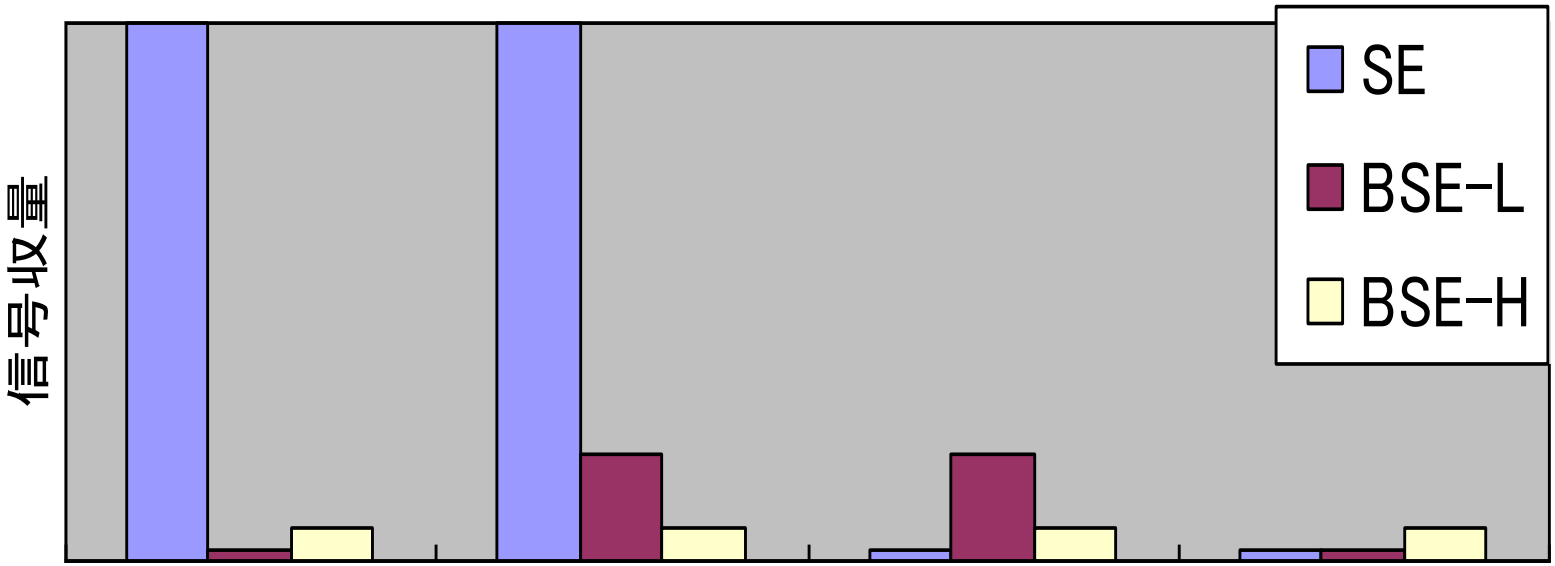


SE(U,LA100)

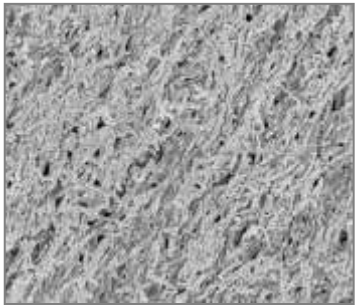


SE(U,HA)

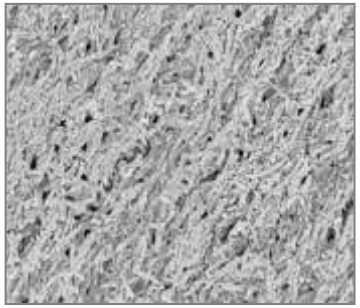
3. Super ExB



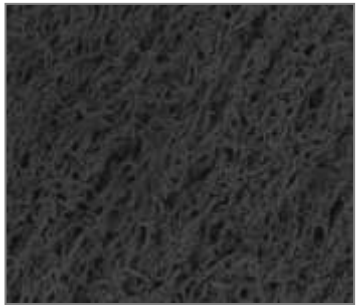
SE (U)



SE (U, LA0)



SE (U, LA100)



SE (U, HA)

3. Super ExB

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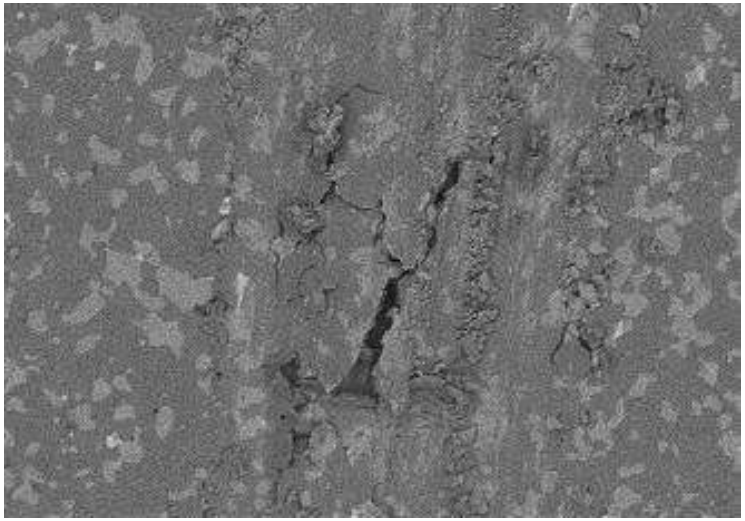
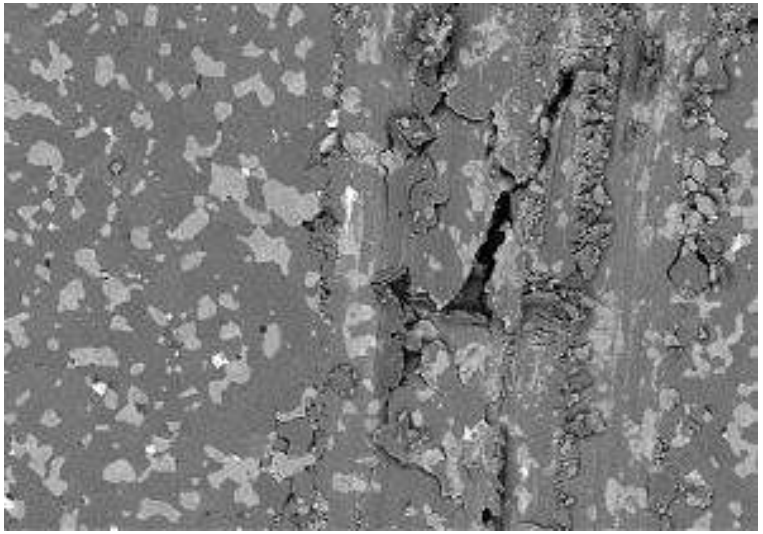
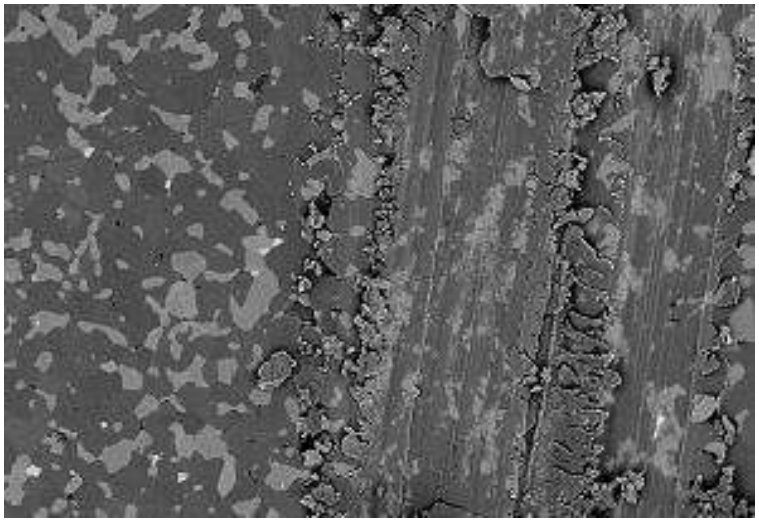
How to get clear image by BSE mode?

Probe current mode → High





缩短 WD



3. Super ExB

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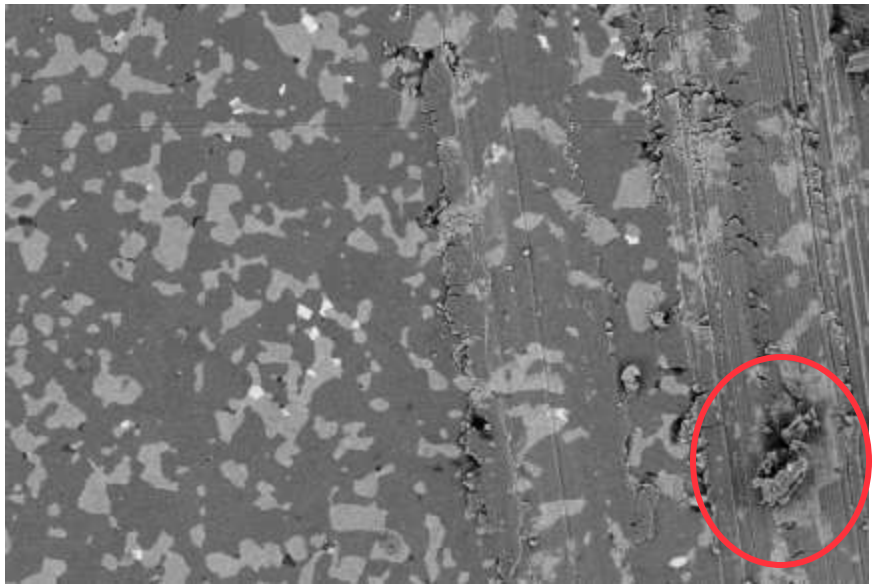
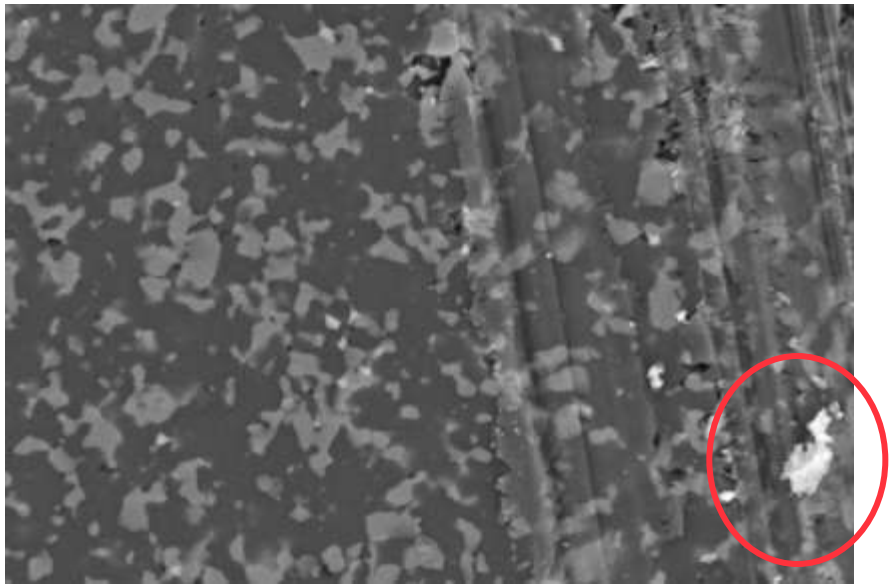
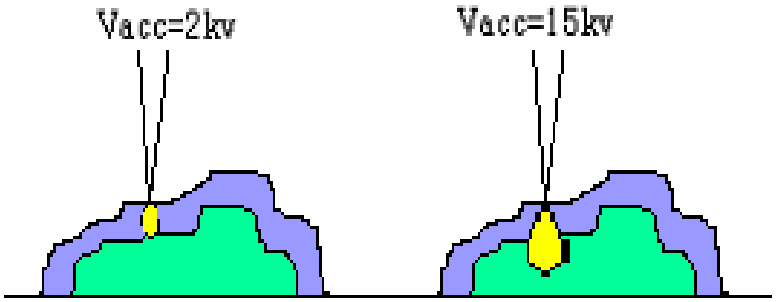
Different Vacc in Super ExB







Information source changes by changing Vacc.

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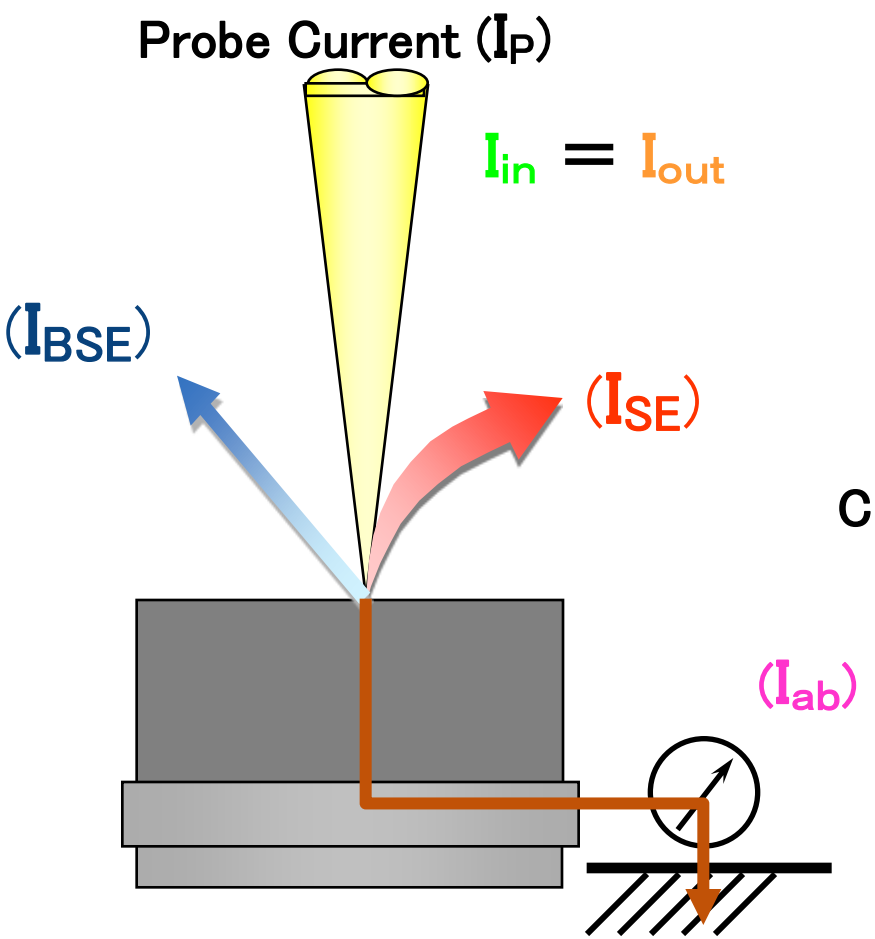
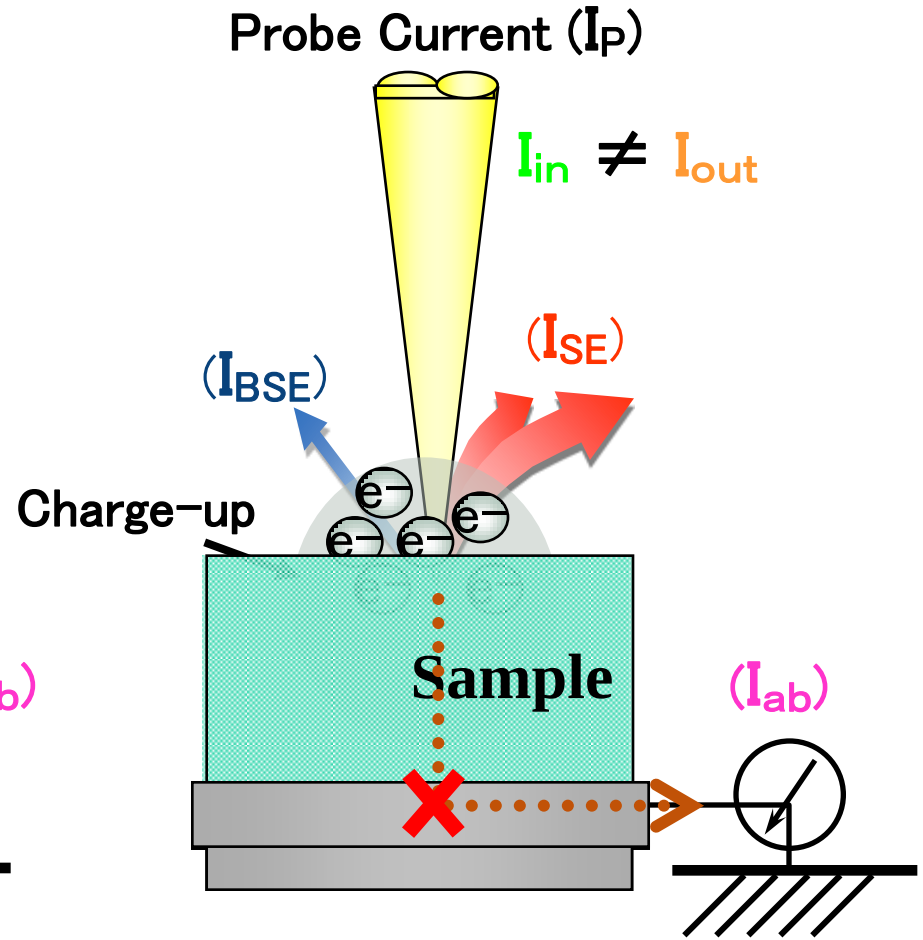
4. Charge-up



(a) Conductive sample



(b)non-conductive sample

Reason for charge-up

$I_{in} = I_P$

$I_{out} = I_{SE} + I_{BSE} + I_{ab}$

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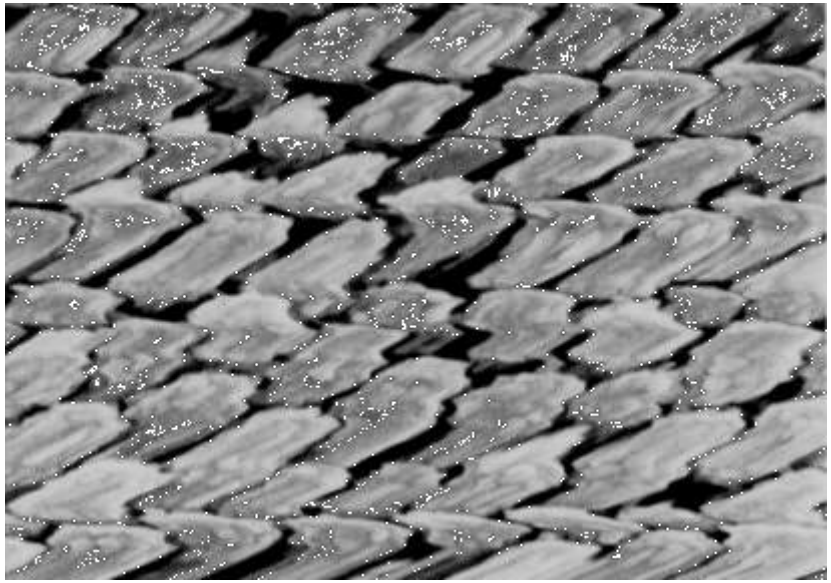
Charge-up phenomenon

Charge-up lines

Image shift



4. Charge-up

HITACHI
Inspire the Next

How to decrease Charge-Up

- Coating（Au、Pt、C…）

Advantage:

（1）conductive→decrease charge-up

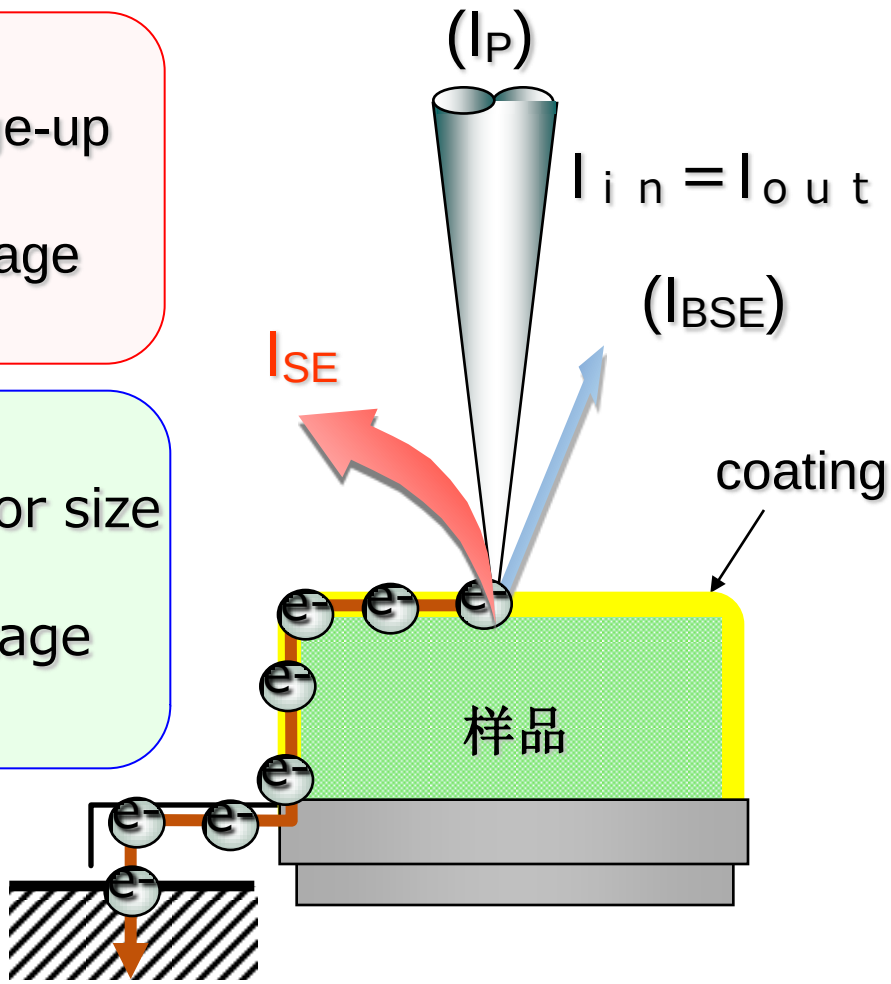
（2）improve thermal transmissibility→reduce beam damage

（3）increase SE detection rate

Disadvantage:

（1）sample surface structure or size maybe changed

（2）composition，surface voltage contrast information disappear



4. Charge-up

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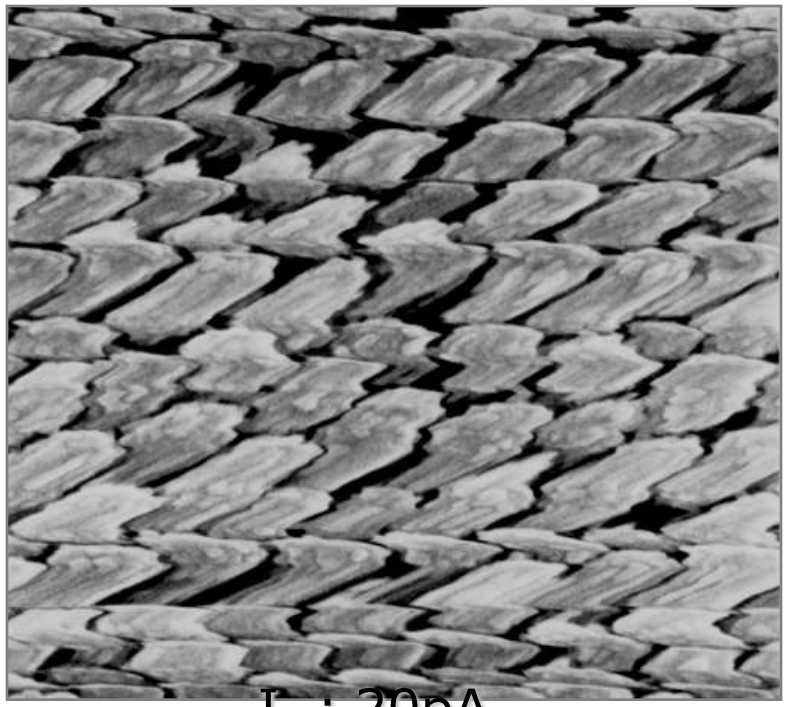
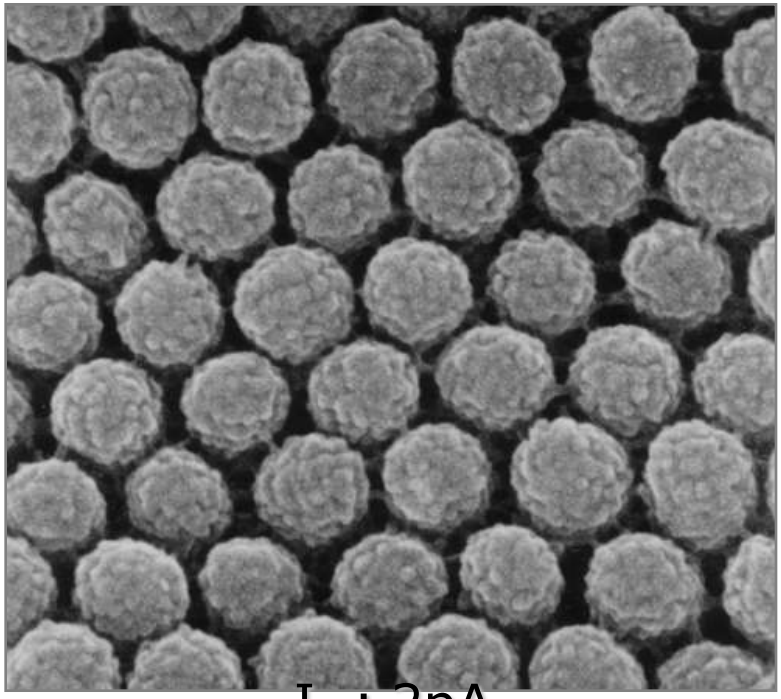
How to decrease Charge-Up

- Ip ↓



I_p : 20pA



I_p : 2pA

Vacc：7kV
Sample：Chorion of rat intestine

4. Charge-up

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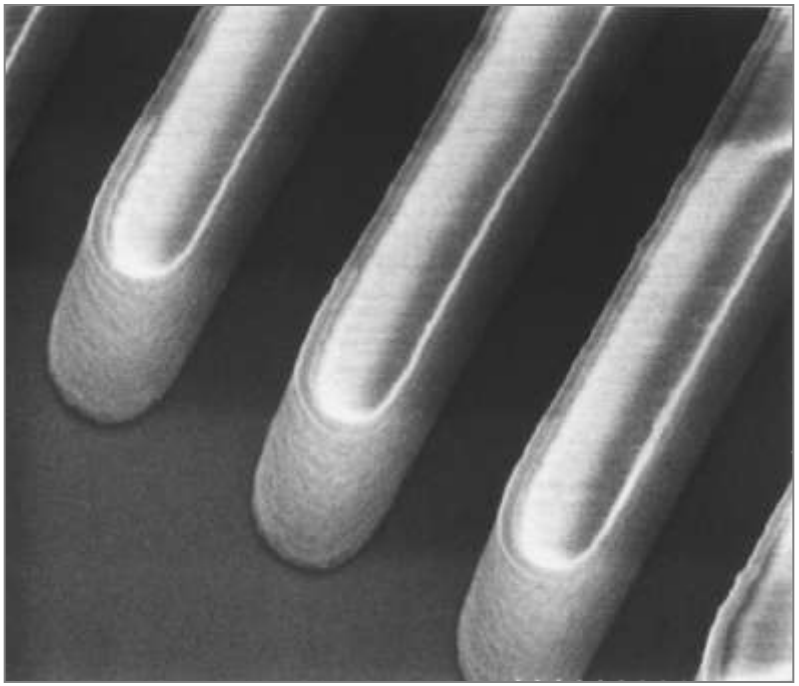
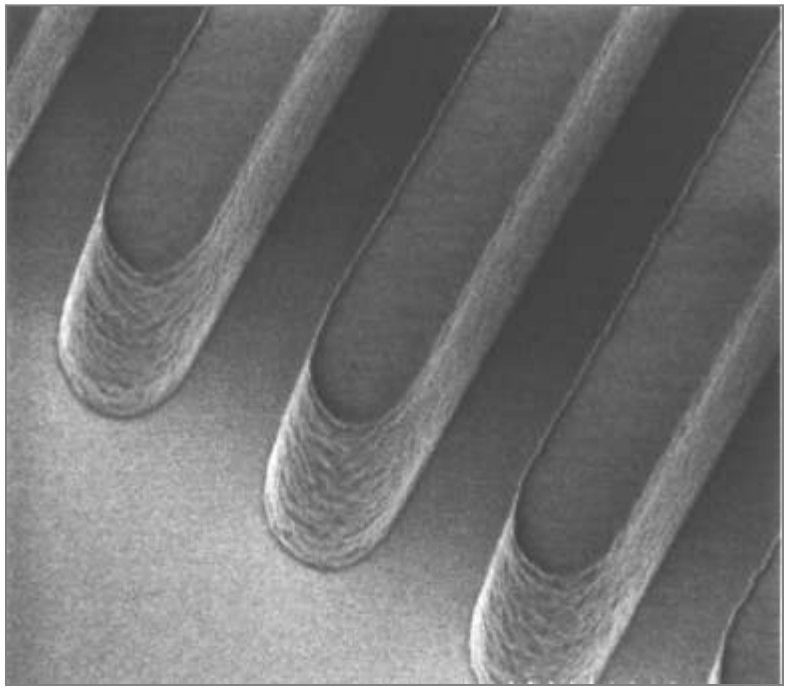
How to decrease Charge-Up

- Vacc ↓



Vacc : 1.5kV



Vacc : 0.7kV

Sample：light-sensitive film on SiO2

4. Charge-up

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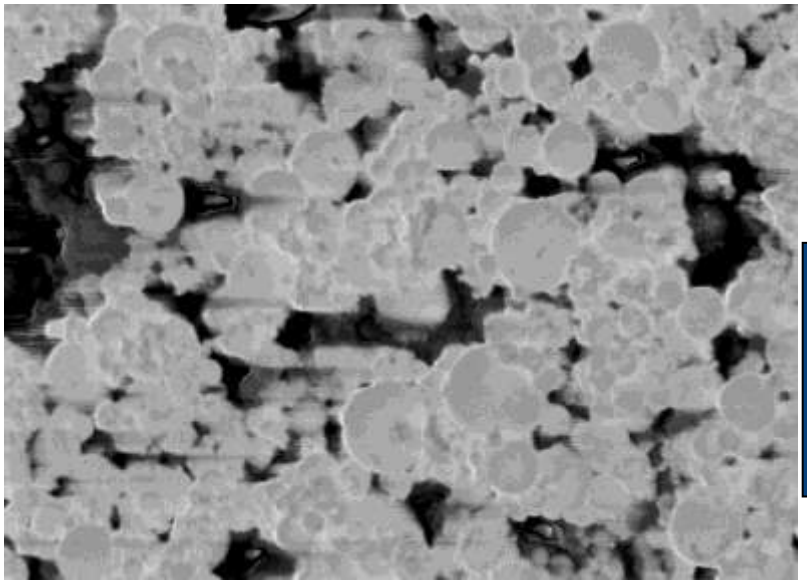
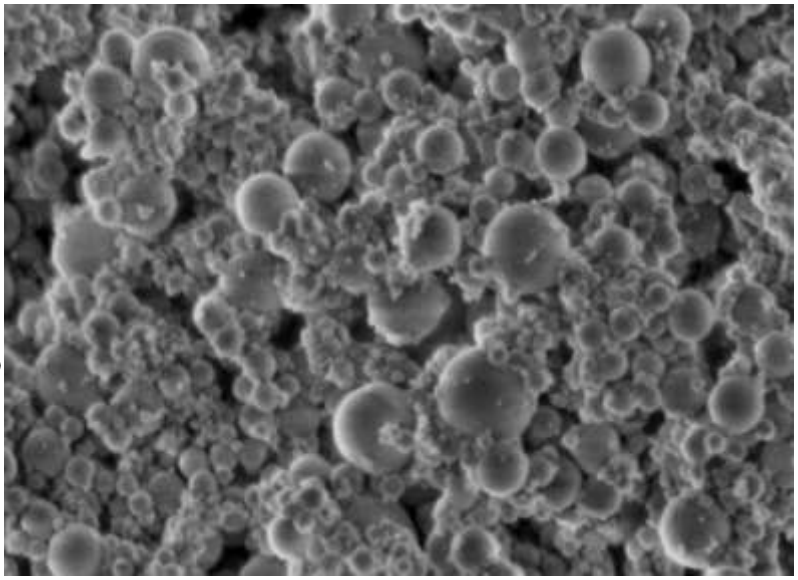
How to decrease Charge-Up

- Integration Capture





Slow Capture：40 sec

Integration Capture : 64 frames

Sample：SiO2 particles

4. Charge-up

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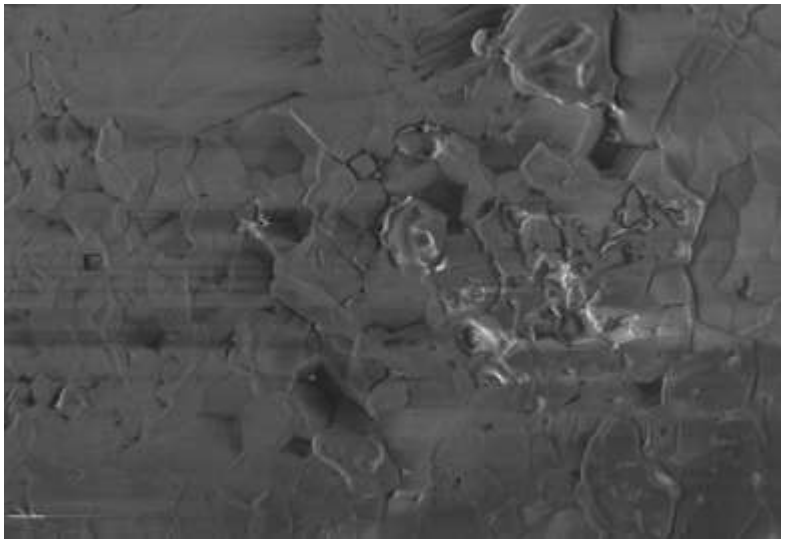
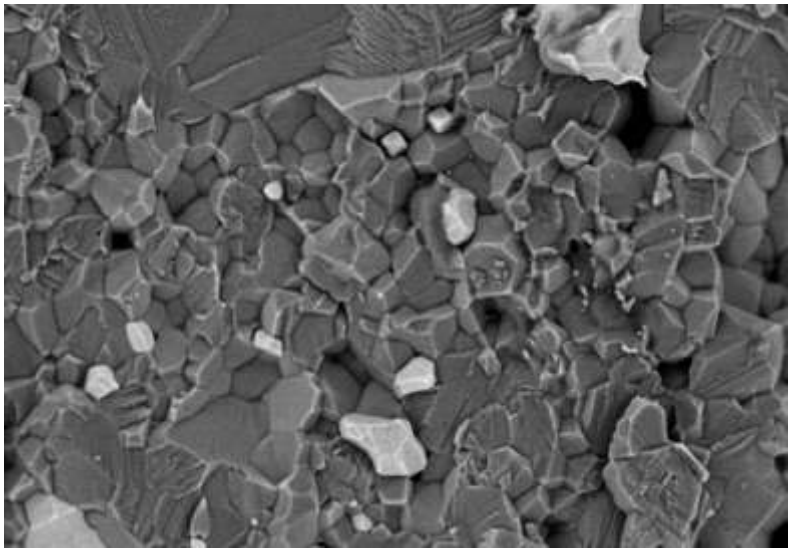
How to decrease Charge-Up

- BSE or Low Detector mode





SE（U）　　SE（U，LA100）

Sample：　Alumina/Nickel Composite
Sample provider：ＩＳＩＲ,Osaka University
関野　徹 (Tohru Sekino)

4. Charge-up

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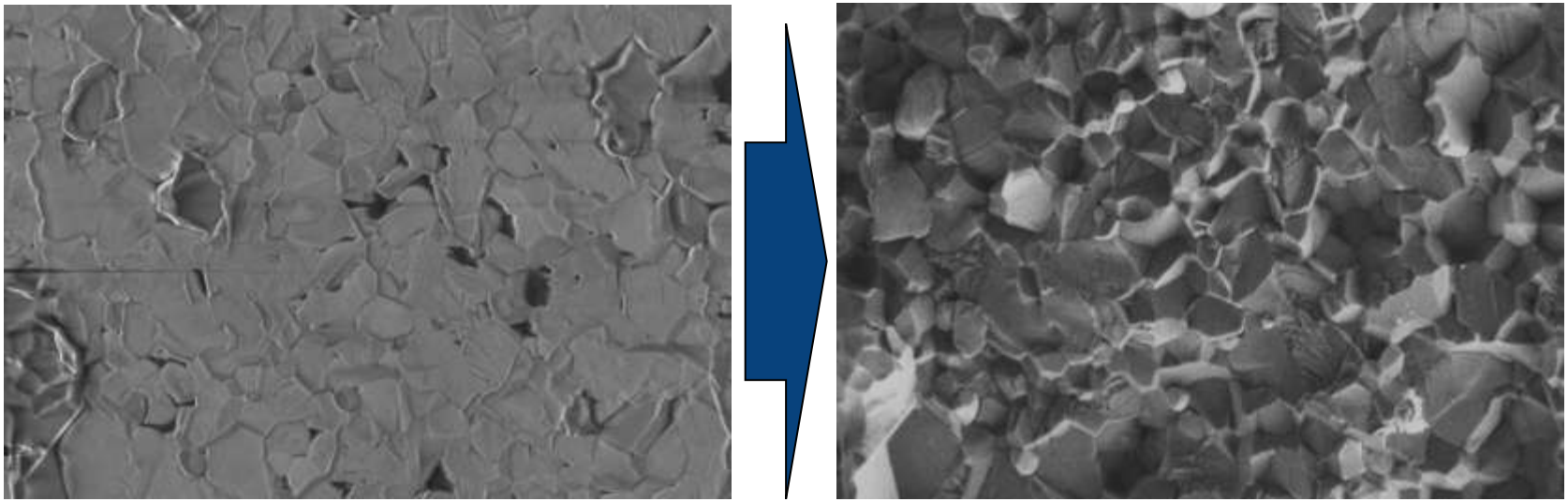
How to decrease Charge-Up

- BSE or Low Detector mode



SE（U）　　SE（L）

Sample：　Alumina/Nickel Composite
Sample provider：ＩＳＩＲ,Osaka University
関野　徹 (Tohru Sekino)

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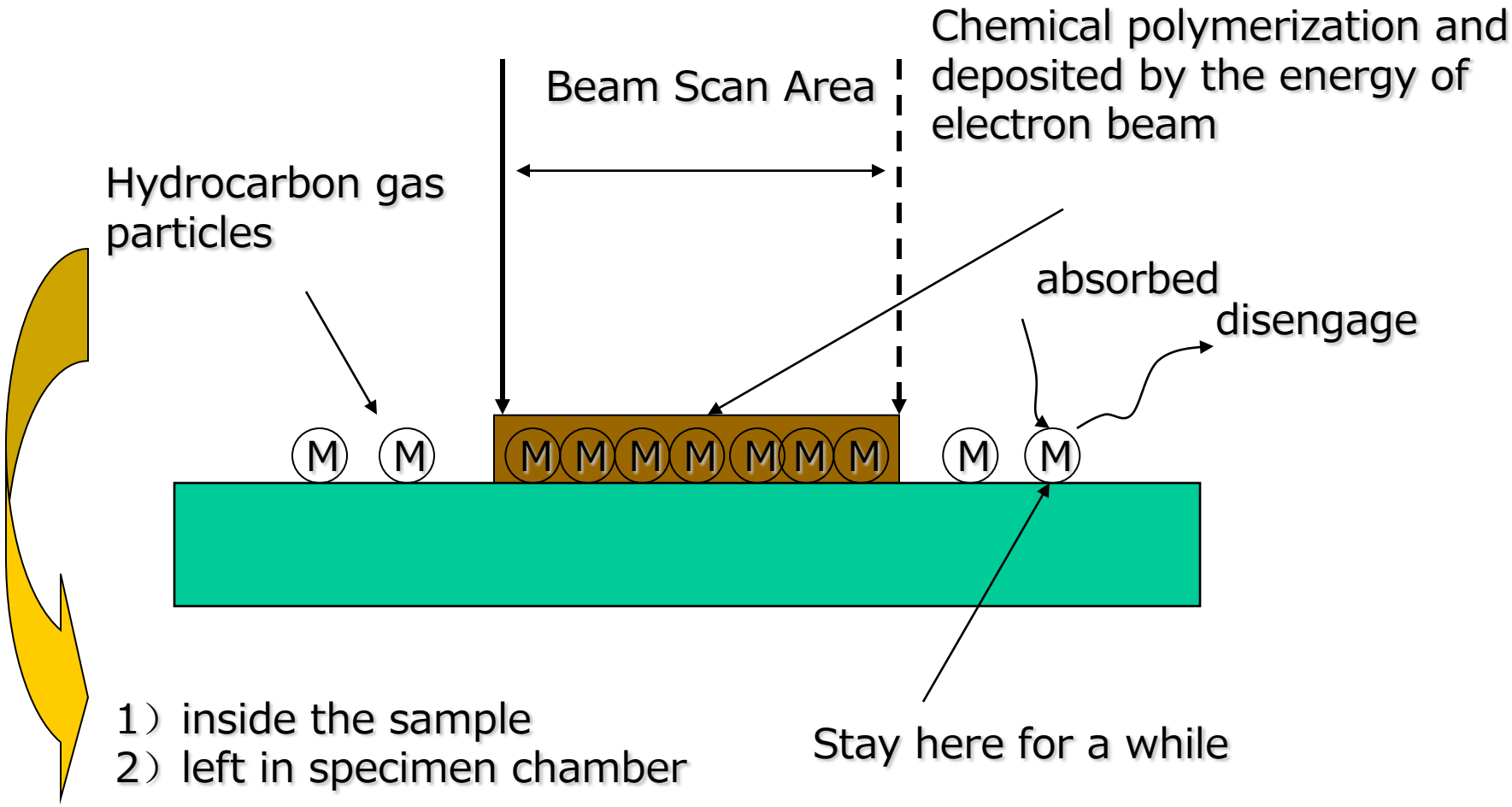
5. Contamination



5. Contamination

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How to decrease Contamination?

1.Preparation
- heating　about 100°　for 1~2hr
- plasma cleaning　30sec~1min
- keep sample in high vacuum chamber all night before observation
  (make sure that all the Pumps without using oil)

2.Observation
- Vacc ↑
- Ip ↑ or ↓
- BSE mode

3.Anti-contamination trap (LN2)

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6. Deceleration

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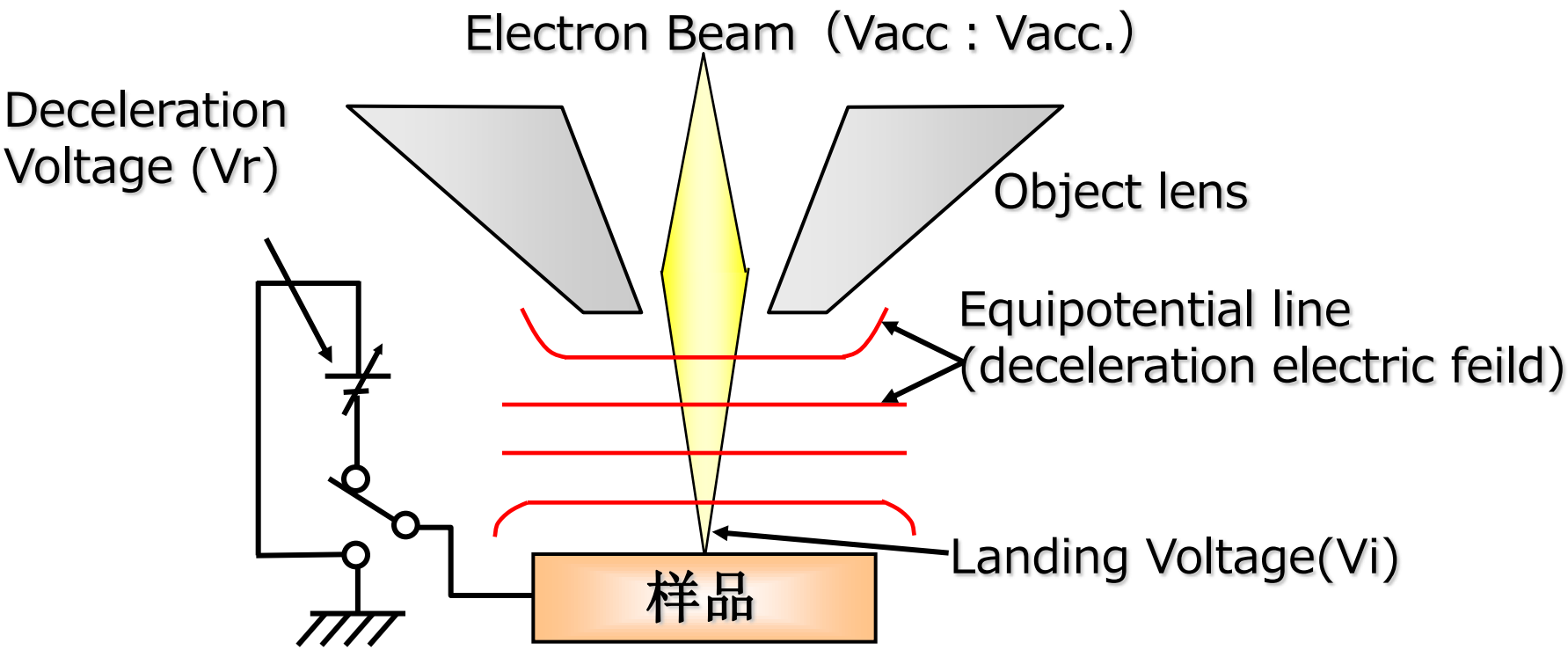
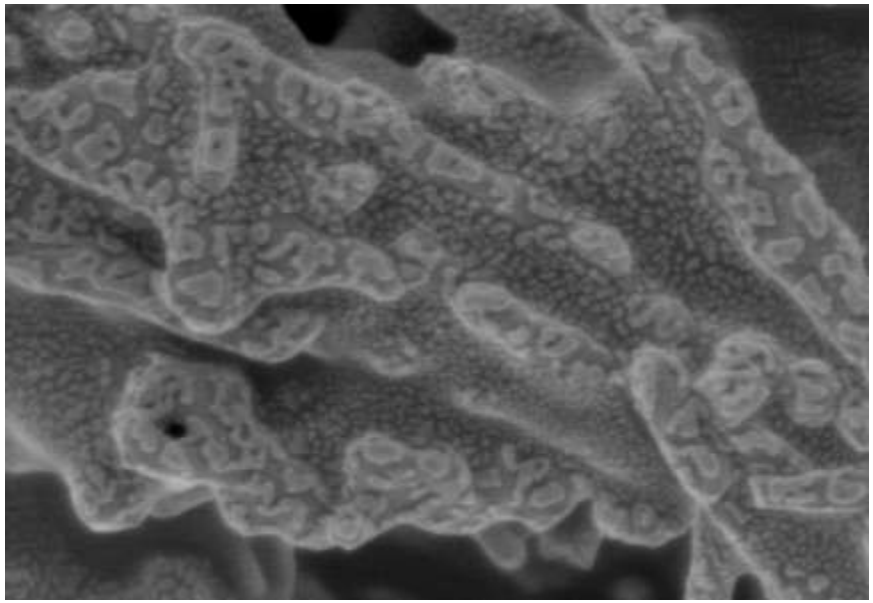
Deceleration $(V_i) = (V_{acc}) - (V_r)$

Beam Damage ↓

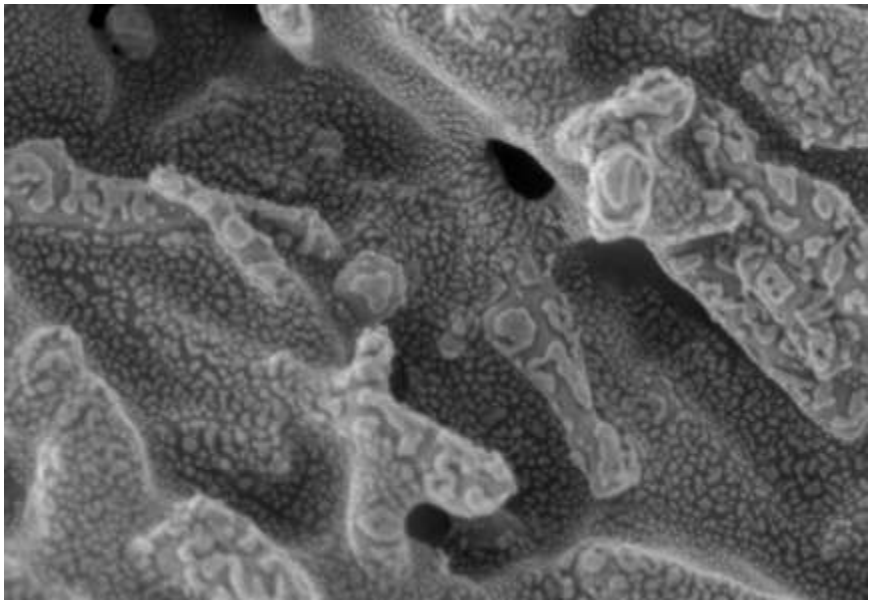
Fine surface observation



6. Deceleration



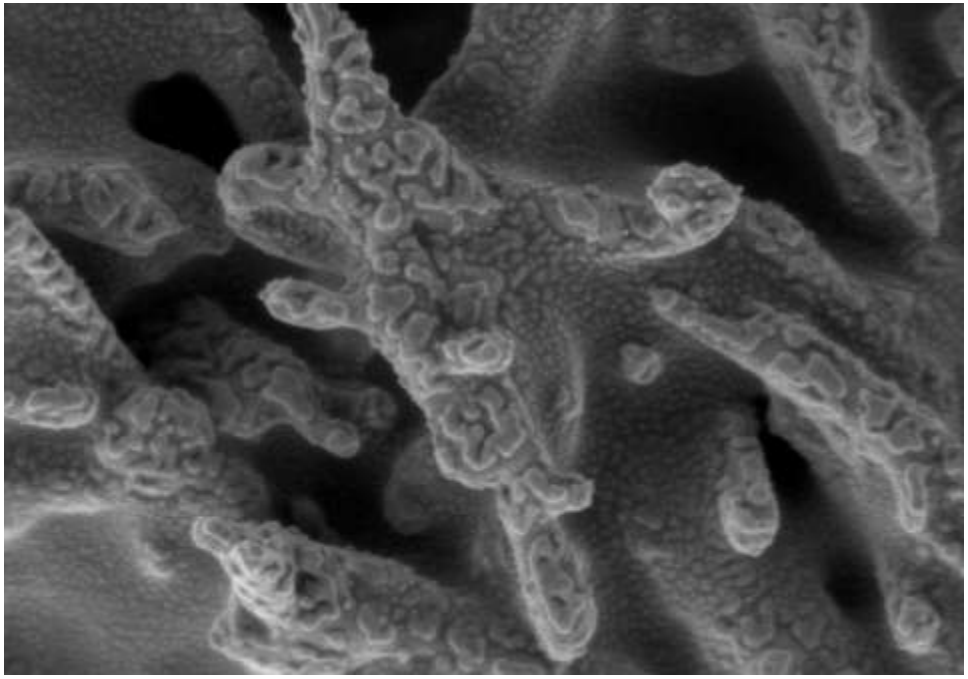
Normal mode



Deceleration mode

Advantage: Higher resolution than normal mode

6. Deceleration



Advantage: possible to observe at lower Vacc (under 500v)

6. Deceleration

HITACHI
Inspire the Next

NG case for deceleration fuction

- Tilted sample
- Rough surface sample
- Near sample edge
- Cross section

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