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# Solution of inconsistency between SEM image and Crystal orientation obtained by SEM-EBSD systems

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Digest version 2016/5/25 Last update 2016/6/18 Q: Is there any way to obtain consistent relationship between SEM images and crystal orientations obtained by EBSD without image rotation after the acquisition?

A: Yes. We propose to input the appropriate setting parameters of the sample tilt and detector orientation: Sample Tilt (degree) = -70 (minus 70) Detector Orientation = 180, 90, 0 (JEOL JSM-7001), 180, 102, 0 (FEI Quanta, Helios)

These parameters are not official statement of Oxford instruments. If you have any questions, please e-mail to "miya@kueps.Kyoto-u.ac.jp".

SEM Panel	Detector Orientation	
Tilt angle [*]: Acceleration Voltage [kV] 15 Magnification: 12000	Detector Orientation (*):     Old values:     New values:       Euler 1:     180.000     180.000       Euler 2:     102.802     102.802       Euler 3:     359.741     359.741       Stage tilt axis:     X-axis	
Read now	Refine   Load Defaults   DK	Quanta 200i 3D/Helios

#### EBSP and the crystal orientation indexed with our setting parameters

#### EBSP





Sample tilt: -70 Detector orientation: 180, 102, 0



#### Indexed orientation

## Plot on the Wulff net - upper hemisphere plot -





# **Discussion:**

Reconsider the definitions of sample tilt, detector orientation, and SEM scan direction

## **Definition -Oxford Instruments-**



## Meaning of each parameter



# Oxford instruments setting parameter

Sample Tilt = 70 degree Detector Orientation = (0,90,0)



# Our setting parameter

#### Sample Tilt = -70 degree Detector Orientation = (180,90,0)



Transmission Kikuchi Diffraction (t-EBSD/TKD)

# Relation between sample and EBSD detector







Sample Tilt =  $38^{\circ}$ 

\* 38° in our lab. In general, 0 to 50 °.

# Original setting recommended by Oxford instruments c-axis

 $\cdot$  sample tilt = -38,

Tilt

Euler 1:

Euler 2:

Euler 3:

Stage tilt axis:

kV: 30

-38°

Mag: 15000x

etector Orientation Detector Orientation (\*):

Old values:

0.000

102.000

359.825

<u>0</u>K

Refine

Load Defaults

New values:

0.000

102.000 ≑

359.825 ≑

X-axis

Cancel

- detector orientation
  - = 0, 90(102), 0



# Our setting parameter

- $\cdot$  sample tilt = 38,
- · detector orientation = 180, 90(102), 0

c-axis





# Conclusion

We proposed to set appropriate parameters of "sample tilt" and "detector orientation", to get the consistent data between SEM image and the orientation obtained by standard-EBSD and transmission-EBSD/TKD.

## New setting parameters: Sample Tilt (degree) = -70 (standard-EBSD), +38 (0 to 50) (t-EBSD/TKD) Detector Orientation = 180, 90, 0 (JEOL JSM-7001), 180, 102, 0 (FEI Quanta, Helios)

These parameters are not official opinion of Oxford instruments. Therefore, please send e-mail to miya @ kueps.Kyoto-u.ac.jp.

\* We could not change the CS0 parameter. If you can set the CS0 parameter in your software, you may get the consistent data using the parameters, CS0 = (180,0,0), sample tilt = +70, detector orientation = (180,90(102),0).