

MICROSCOPIE ELECTRONIQUE

(MEB, MET, STEM, FIB)

MICROANALYSE X

(EDX, WDW, EBSD)

PREPARATION D'ECHANTILLONS

ACCESSOIRES

PROFILOMETRIE 3D

TOMOGRAPHIE X



elexience  
PARTENAIRE DE VOS INNOVATIONS



# **MICROSCOPIE ELECTRONIQUE A BALAYAGE EN TRANSMISSION : CONTRAINTE ET SOLUTIONS POUR L'ULTRA-HAUTE RESOLUTION A BASSE TENSION (Low kV-STEM)**

**Peut-on obtenir, avec un MEB, des images nettes et stables à des grossissements supérieurs à  $\times 500.000$  (référence Polaroid) ?**

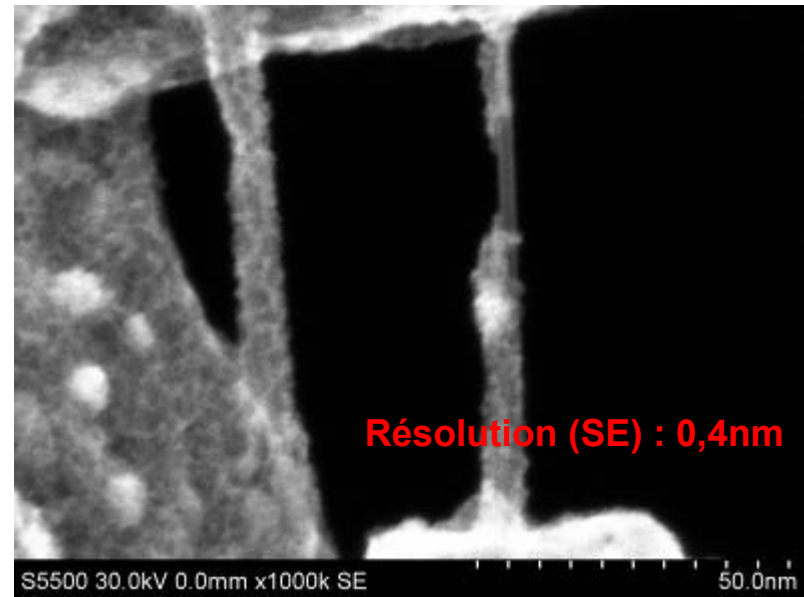
**Peut-on observer et analyser précisément et avec stabilité des objets de dimension inférieure ou égale à 10nm ?**

**La réponse est : oui...**

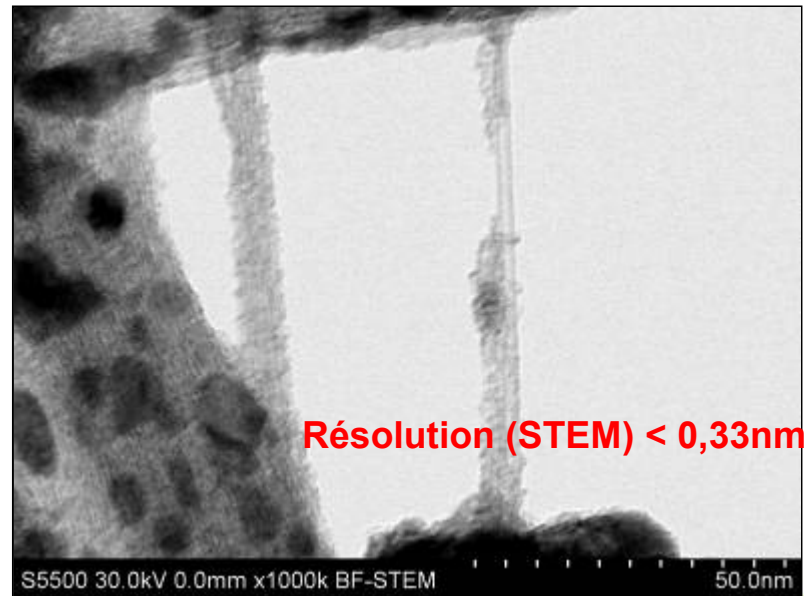
# Instrument



HITACHI S5500 Cold FE Low kV-STEM



Résolution (SE) : 0,4nm



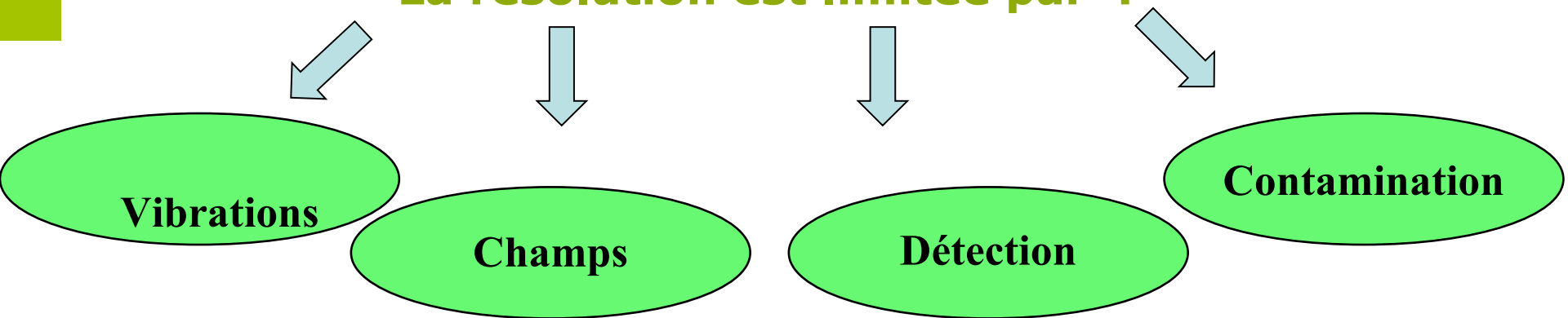
Résolution (STEM) < 0,33nm

single wall CNT

**Résolution théorique = Taille de sonde**

## Mais en pratique.....

La résolution est limitée par :



## Mais en pratique.....

### La résolution est limitée par :

Vibrations

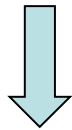


- *Nouveau châssis*
- *Amortisseurs renforcés*
- *Echantillon placé au centre d'inertie de la colonne*
- *Platine goniométrique*
- *Enceinte d'isolation acoustique*

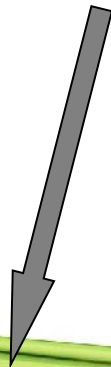
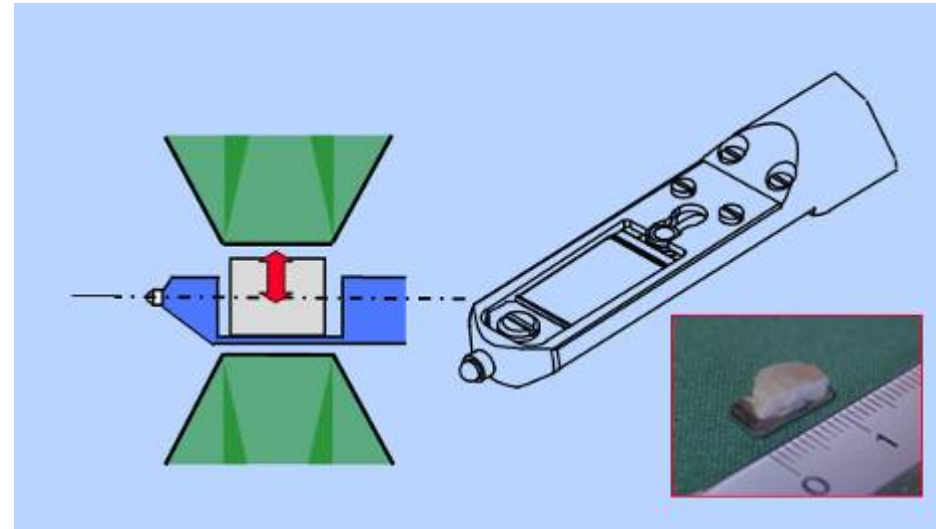


## Mais en pratique.....

### La résolution est limitée par :



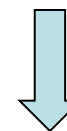
### Champs



*-Echantillon placé entre les pièces polaires de la lentille*



## Mais en pratique..... La résolution est limitée par :

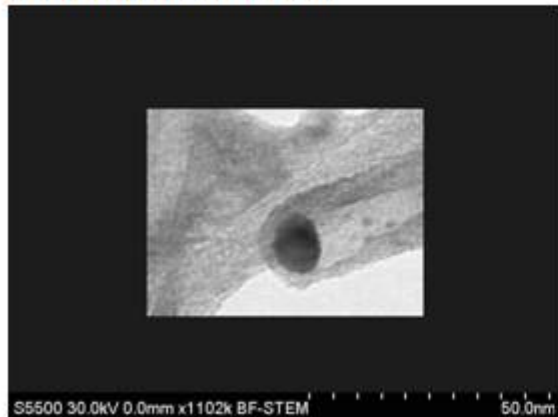


### Contamination



- *Dispositif d'escamotage le faisceau, électrostatique*
- *Pompage sec (TMP à -paliers magnétiques)*
- *Doigt froid et réservoir de vide*

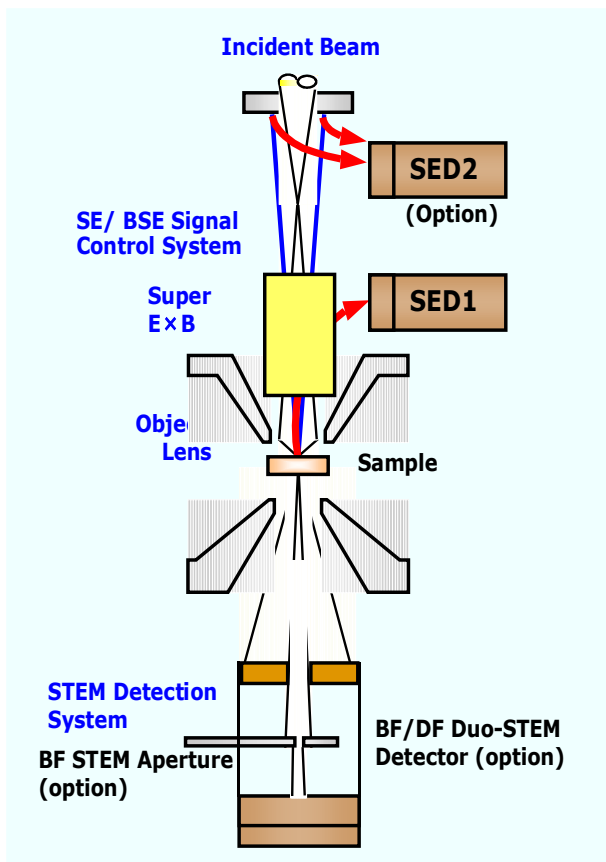
#### Contamination Test



~~~~~

These are carbon nanotubes. Notice the magnification is 1.1Mx. The reduced area was left on this position for five minutes in TV rate. Then a slow scan image of 80 seconds was captured from the same area. There is no indication of contamination in the bright field image or secondary electron image. This was done again for another 5 minutes after with no build up of contamination.

Mais en pratique.....  
La résolution est limitée par :

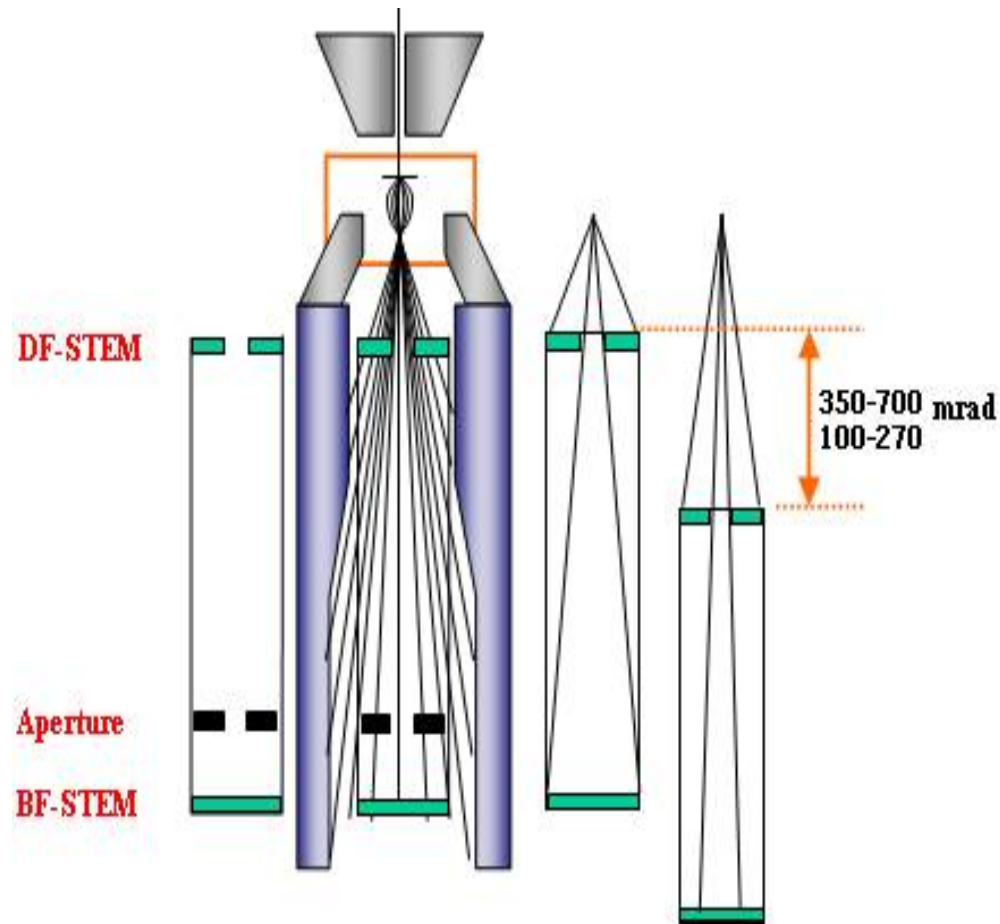
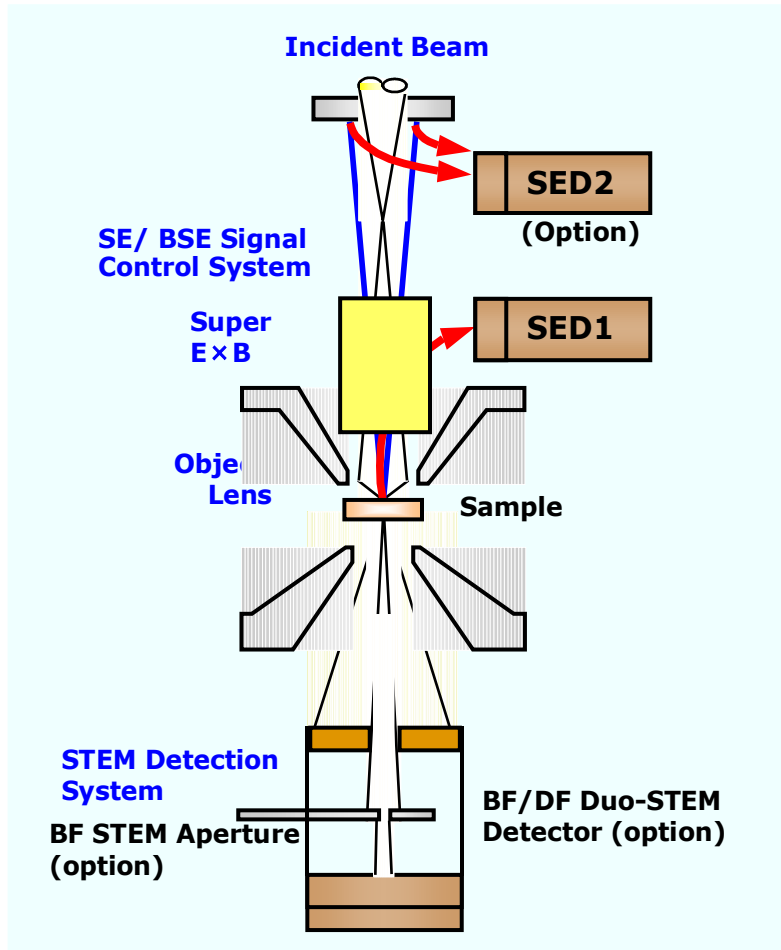


Détection

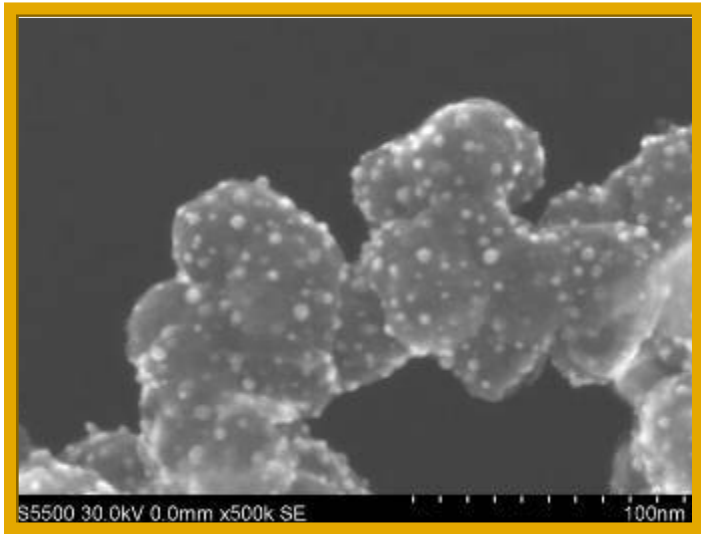


*Détecteur(s) de type ET  
à fort rendement*

# Concept du détecteur BF/DF Duo STEM



# Echantillon : Catalyseur

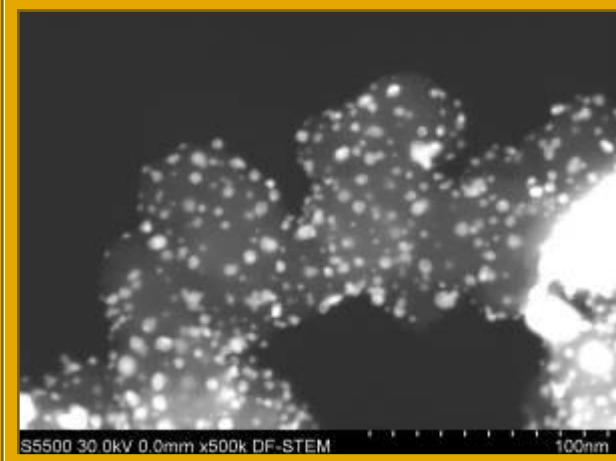
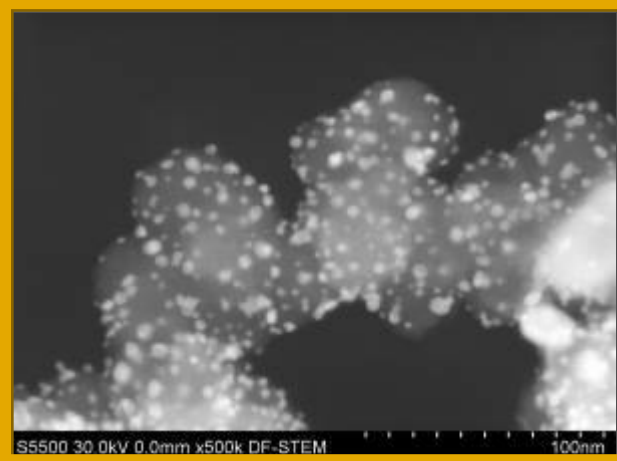
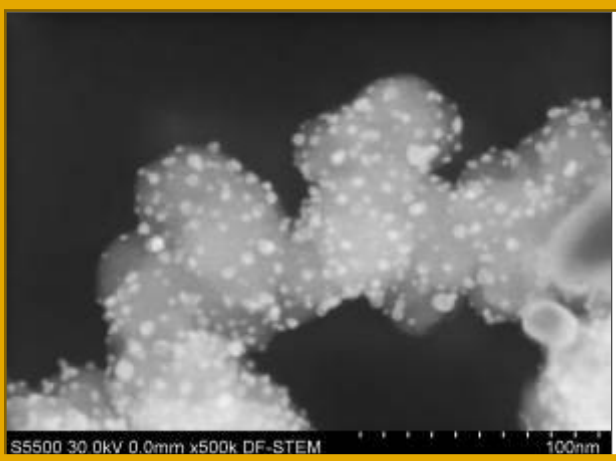


*Catalyst  
SE Image*

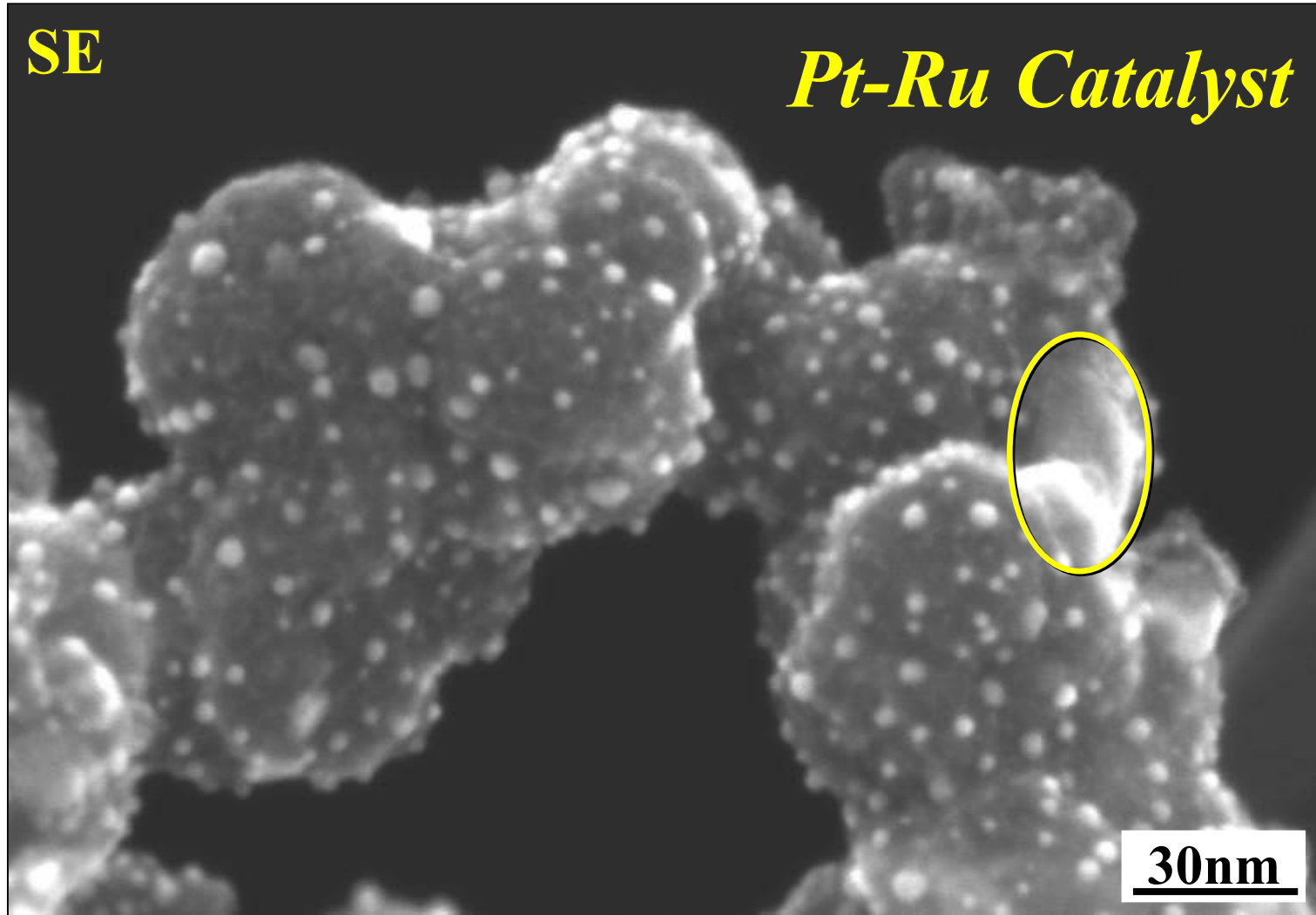
*Small*

*Collection angle*

*Large*



# Applications



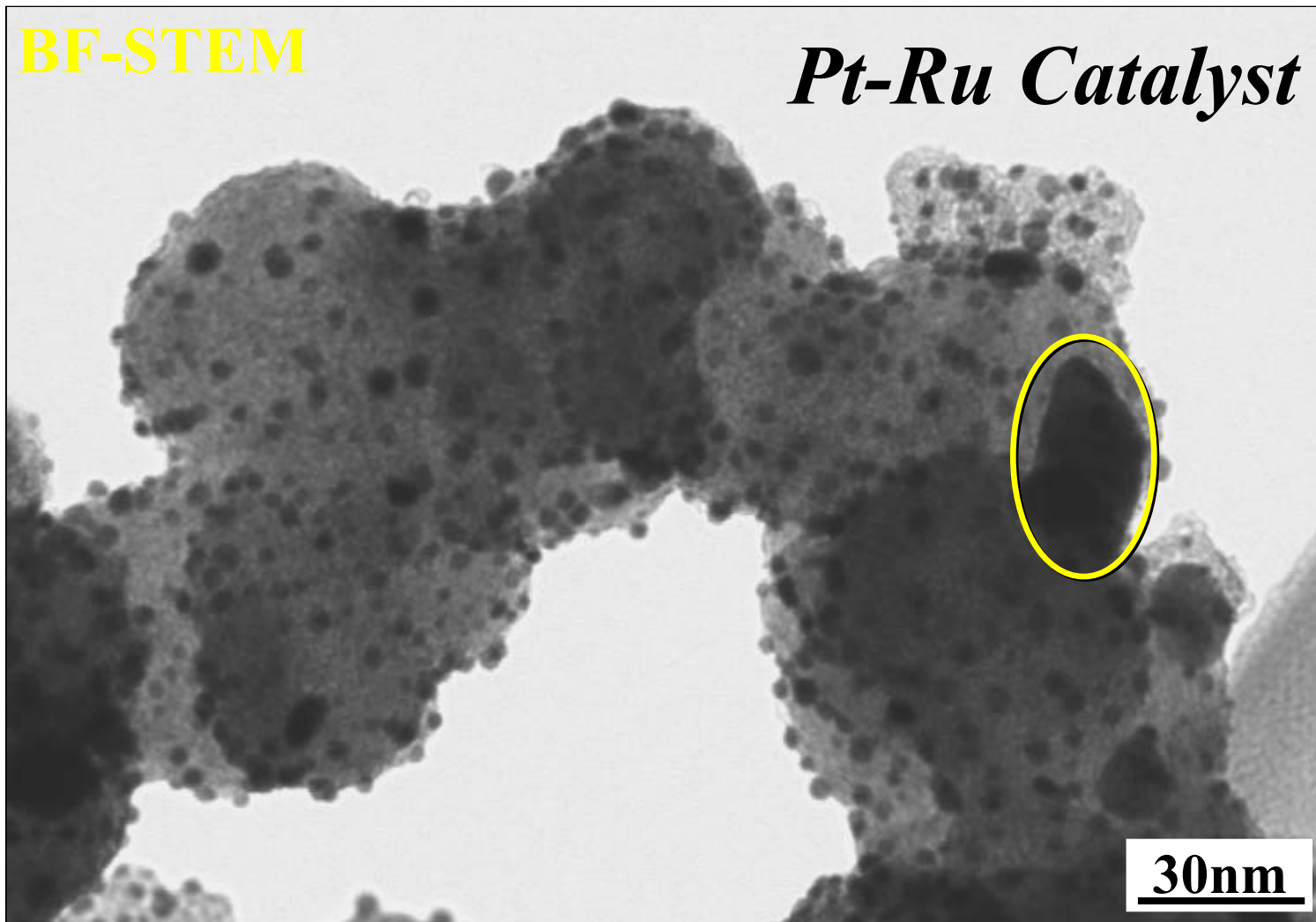
**Vacc : 30kV**

**Mag : 500kX**

# Applications

**BF-STEM**

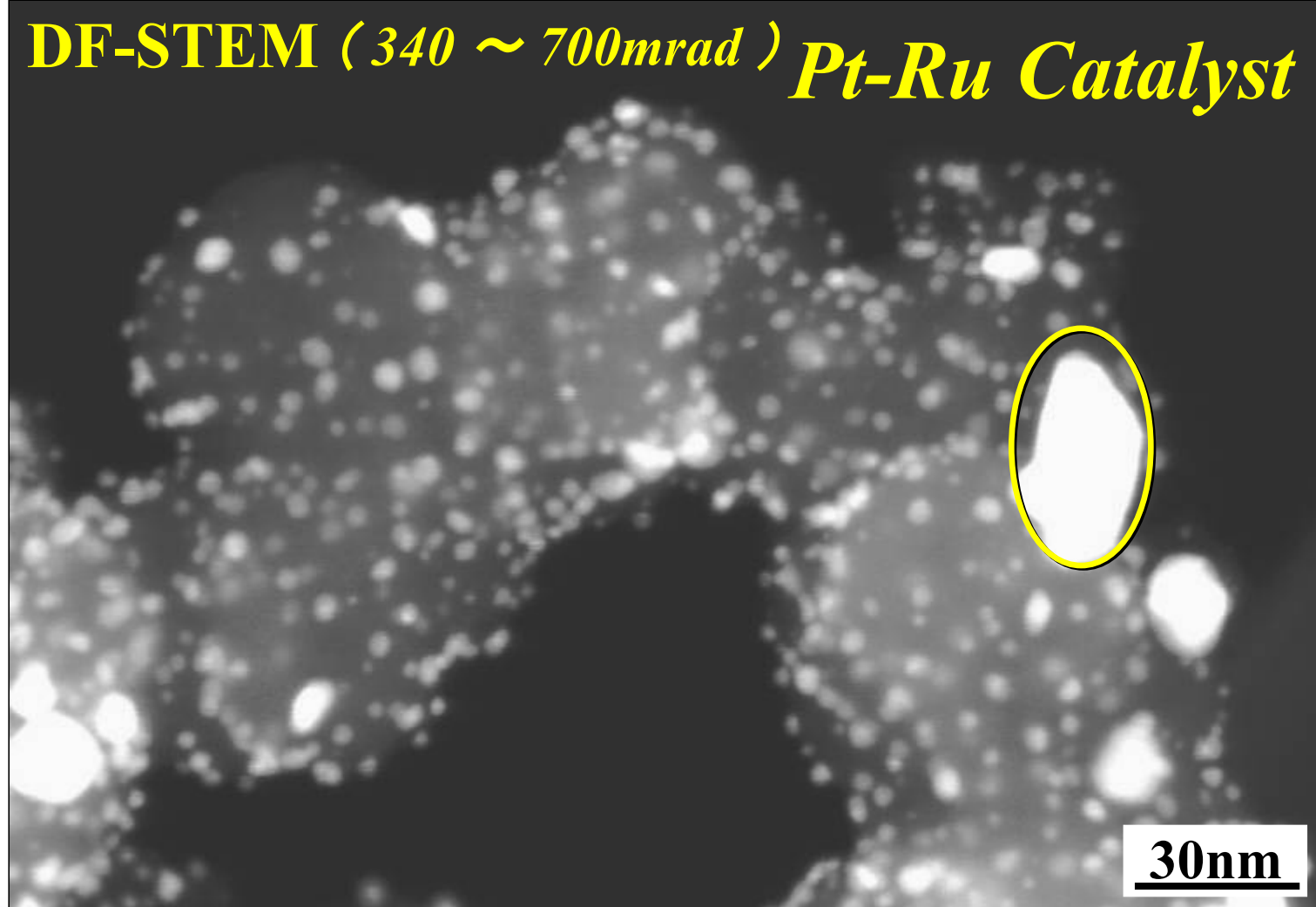
*Pt-Ru Catalyst*



**Vacc : 30kV**

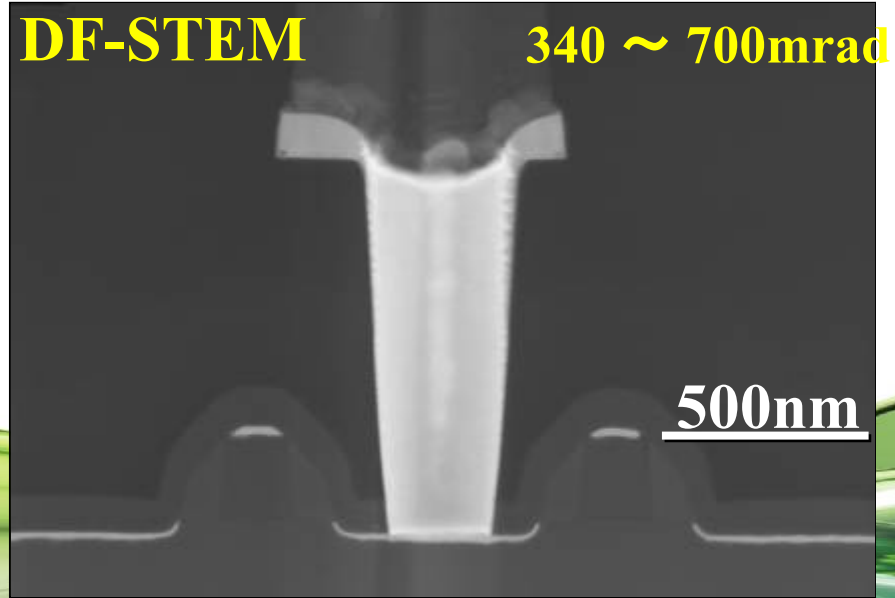
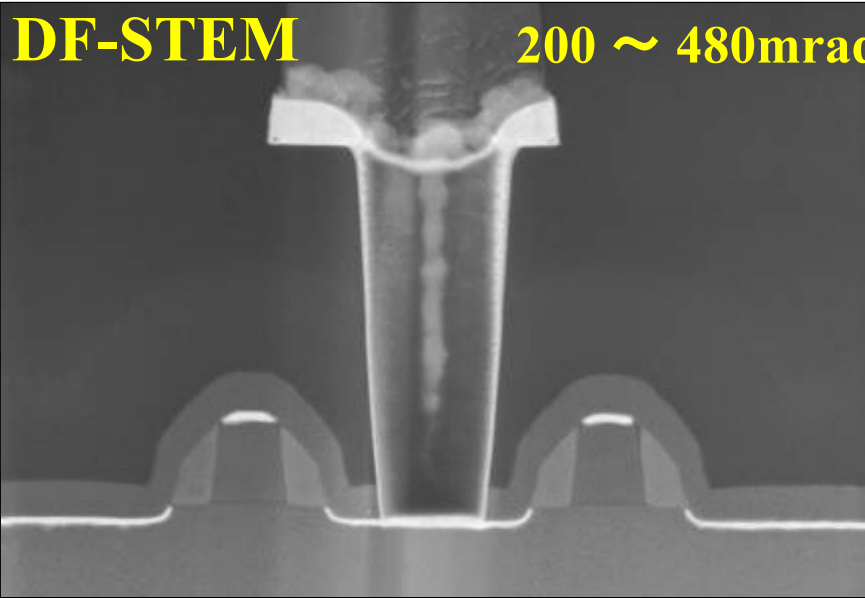
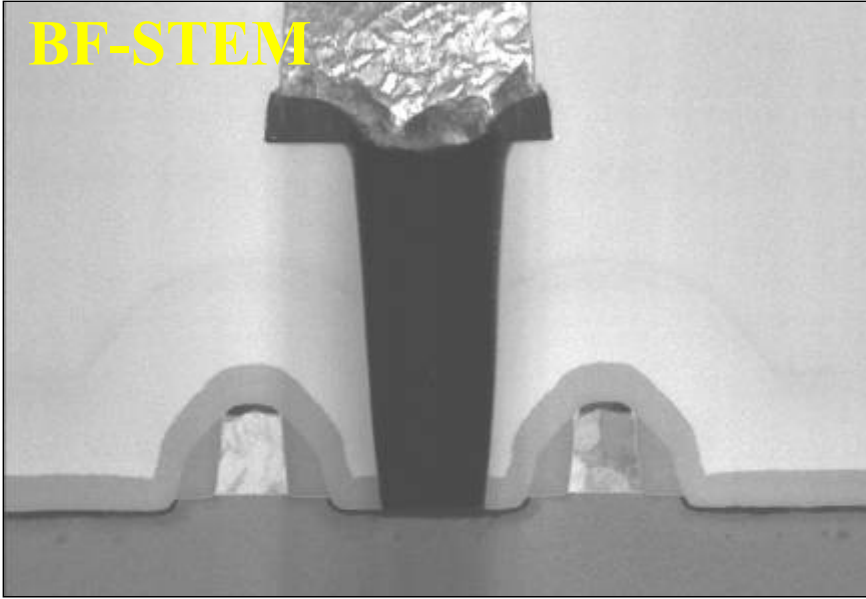
**Mag : 500kX**

# Applications

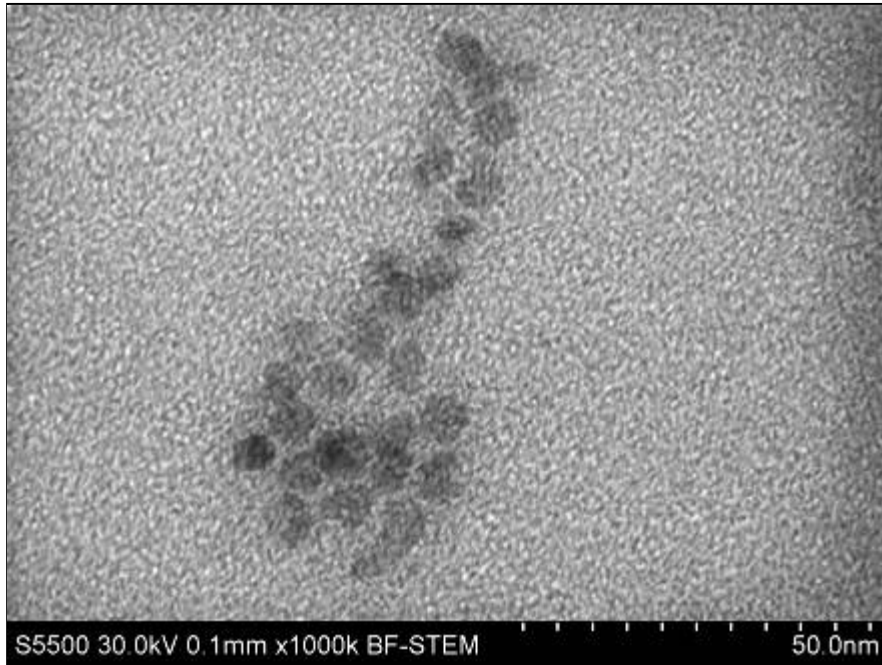


**Vacc : 30kV      Mag : 500kX**

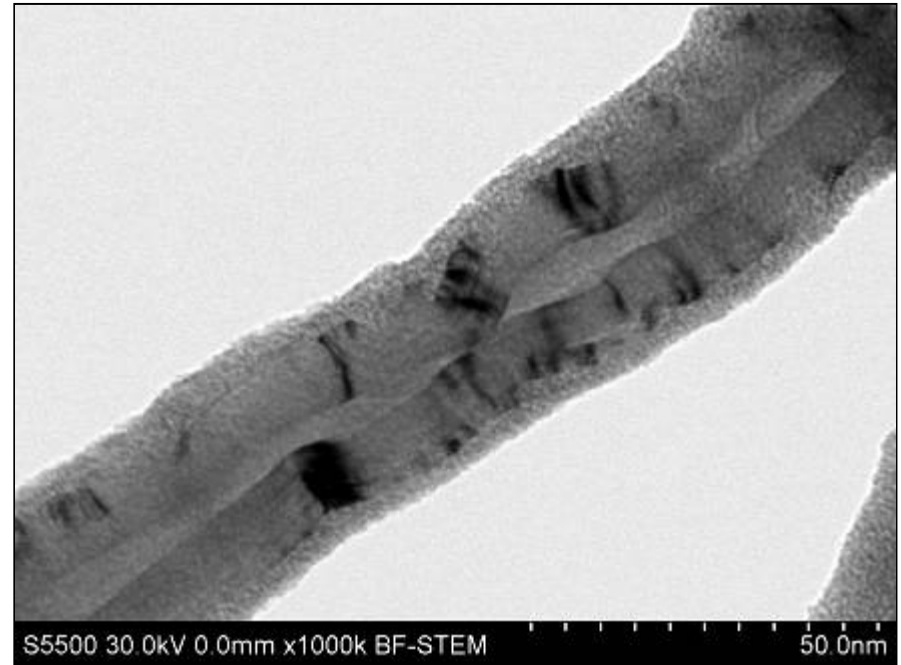
# Echantillon : Contact en tungstène



# Applications

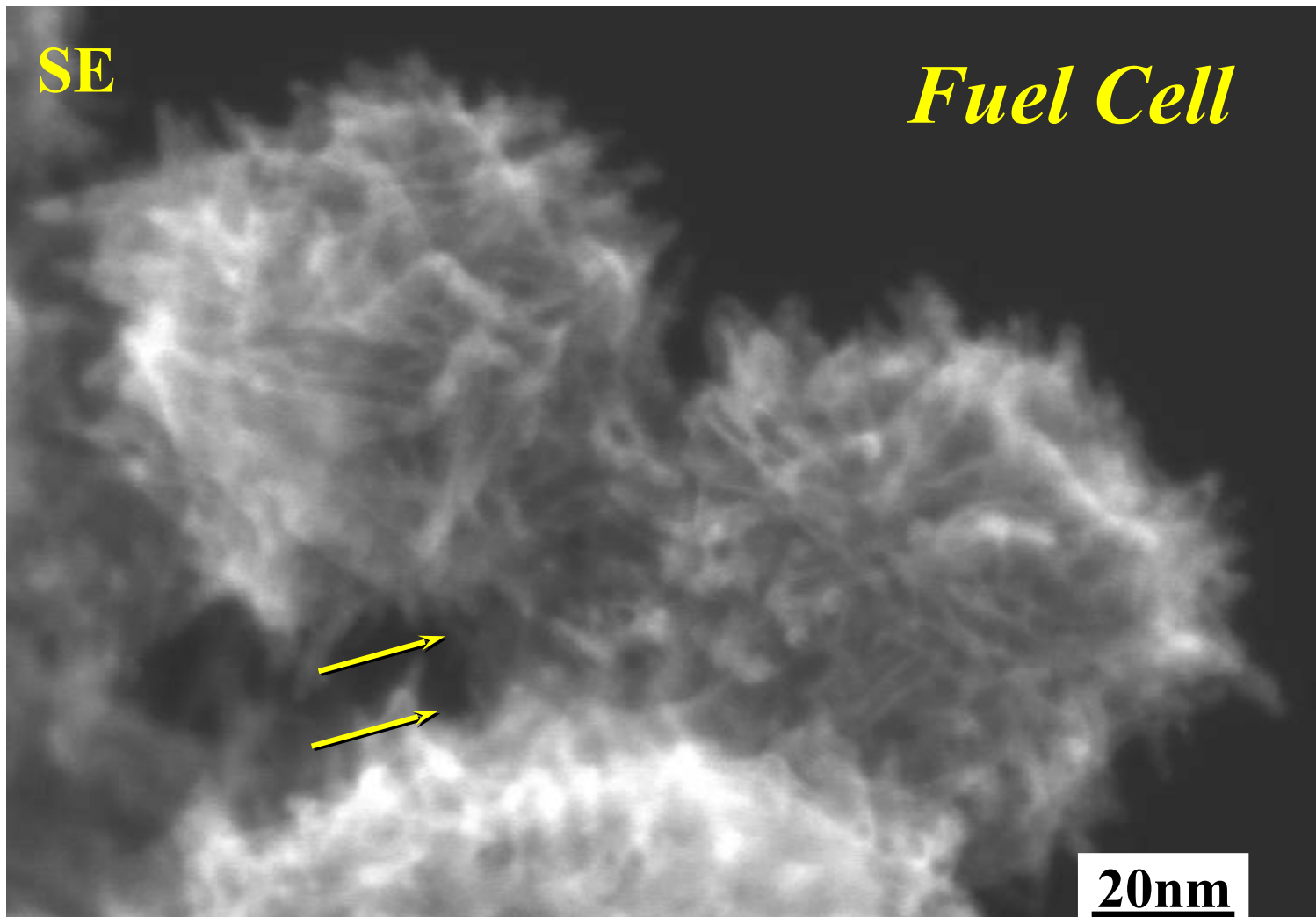


Nanoparticules



Nanotubes de carbone

# Applications



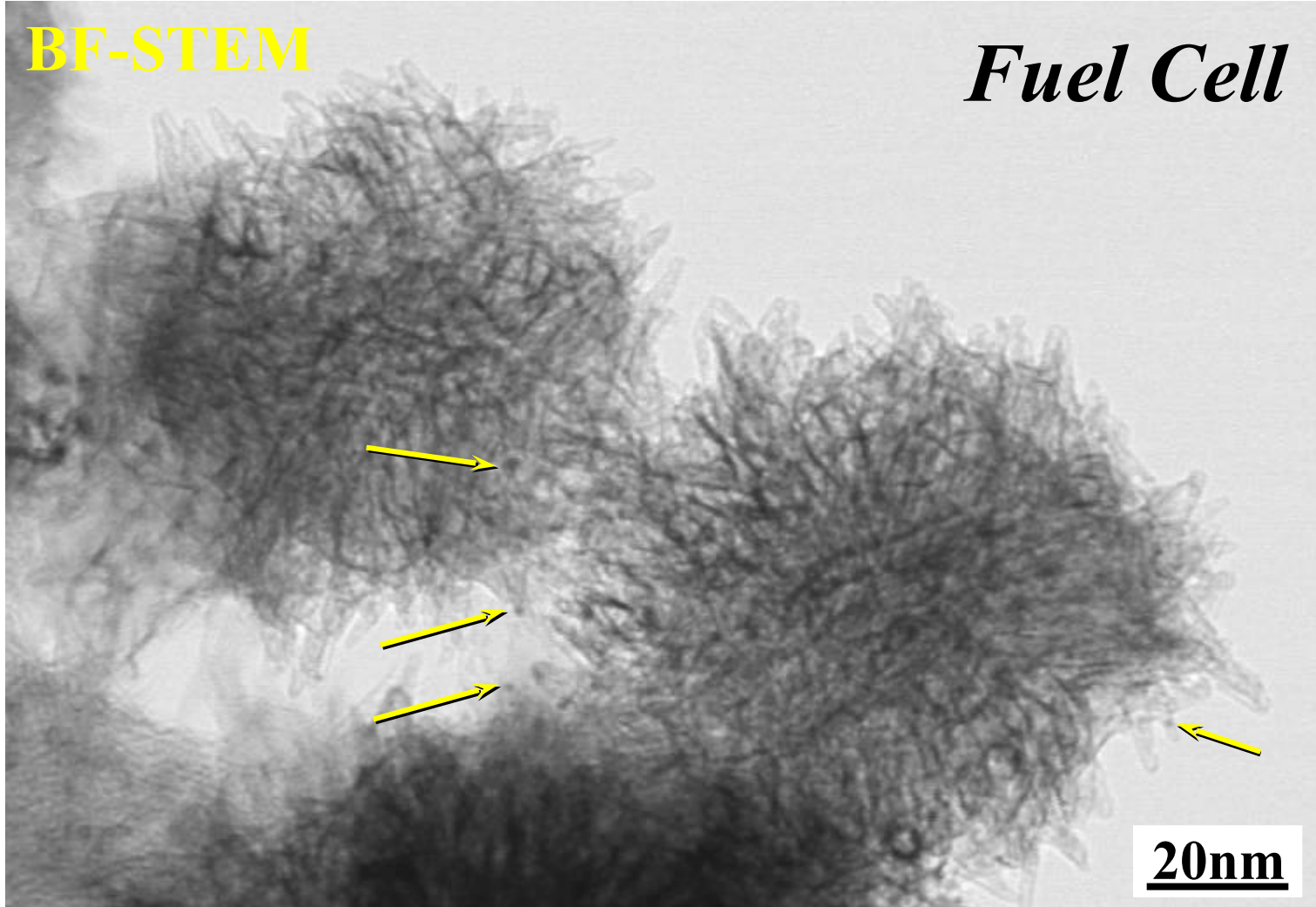
**Vacc : 30kV**

**Mag : 700kX**

# Applications

**BF-STEM**

*Fuel Cell*

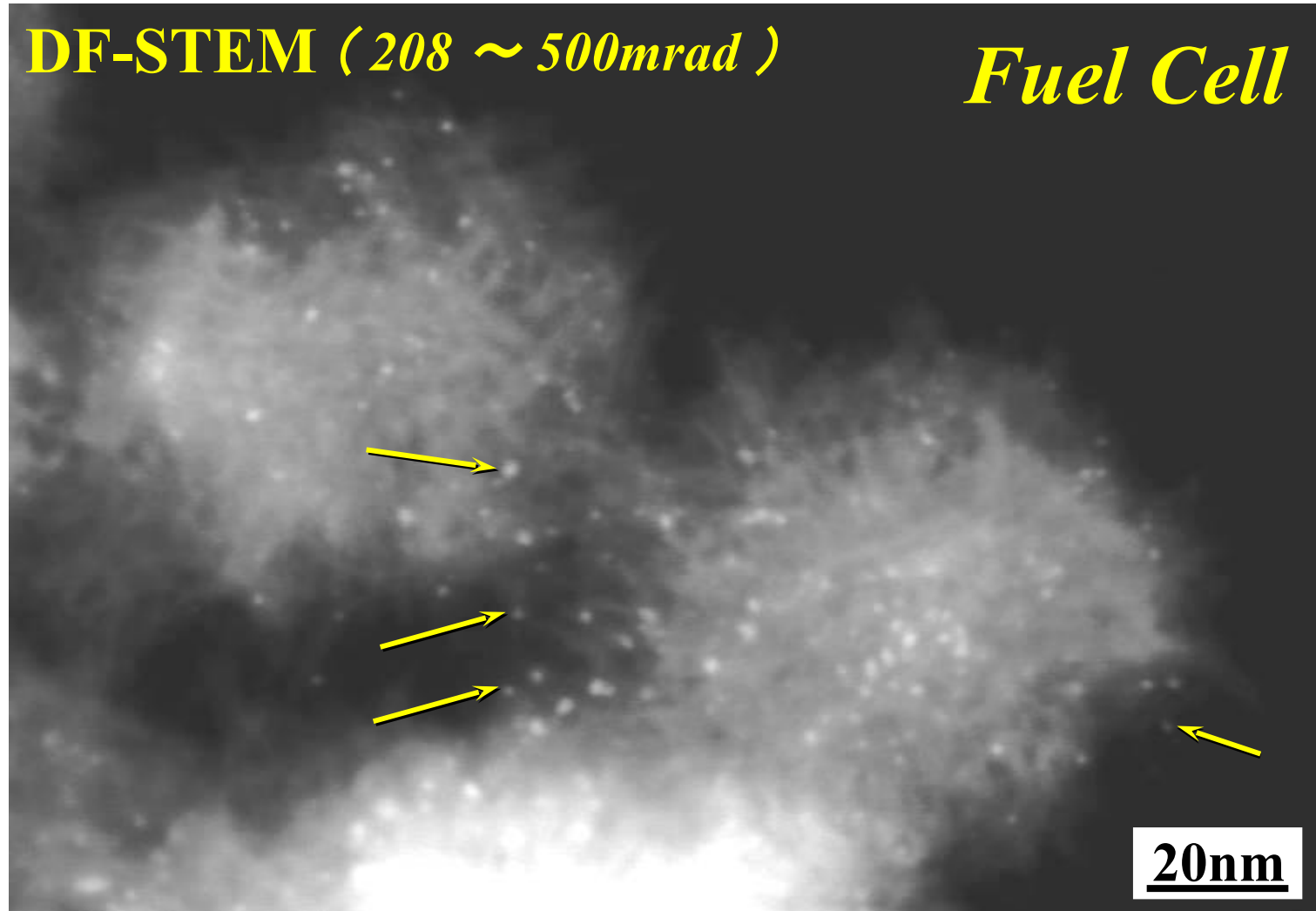


**Vacc : 30kV      Mag : 700kX**

# Applications

**DF-STEM (208 ~ 500mrad)**

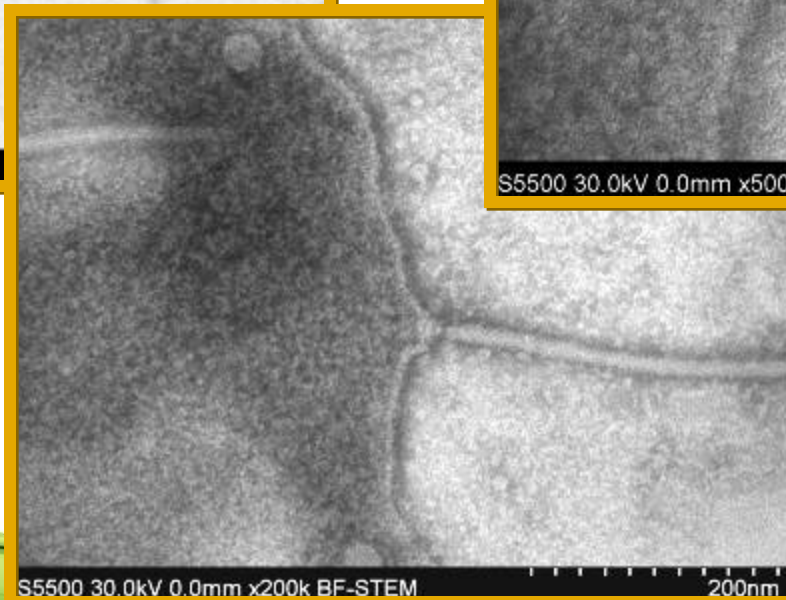
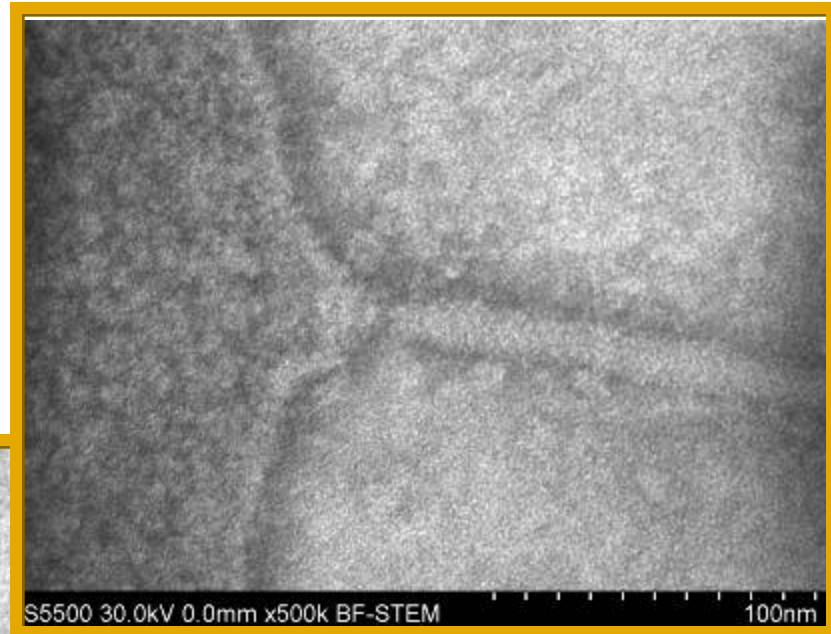
*Fuel Cell*



**Vacc : 30kV**

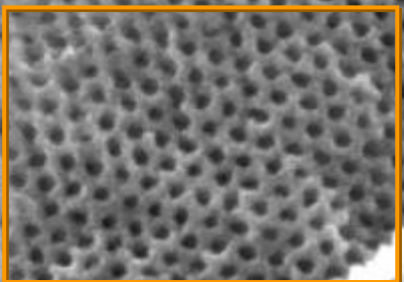
**Mag : 700kX**

# Applications



*Bacteries*

**SE Mode**



**400kX**

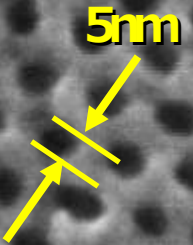
**50nm**

**BF-STEM**

**400kX**

**50nm**

**SE Mode**



**1MX**

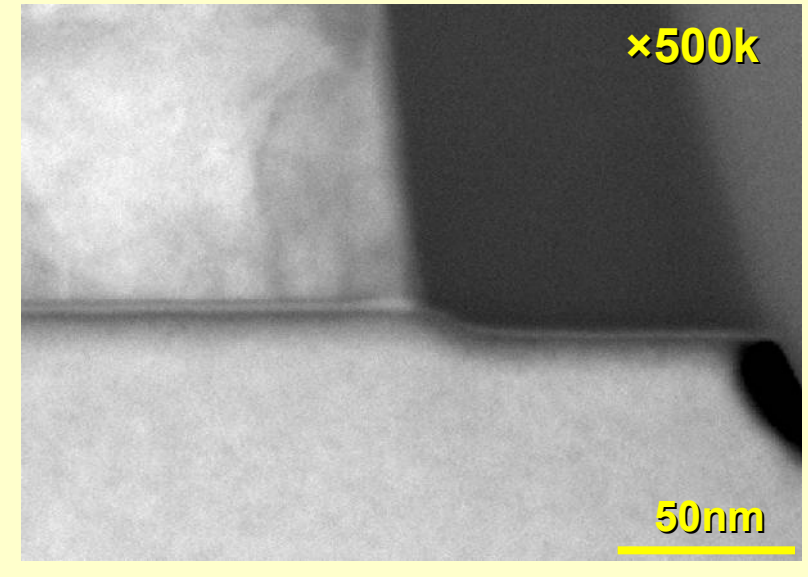
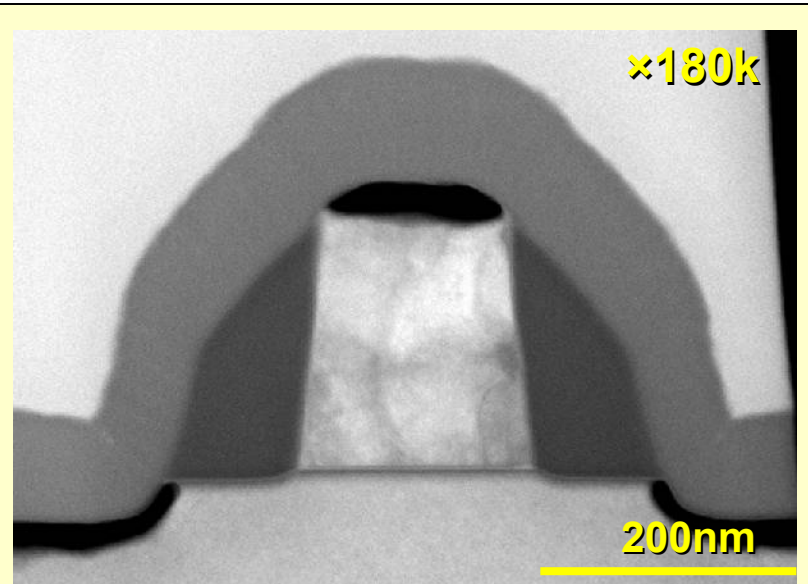
**20nm**

**Echantillon mésoporeux  
Co304**

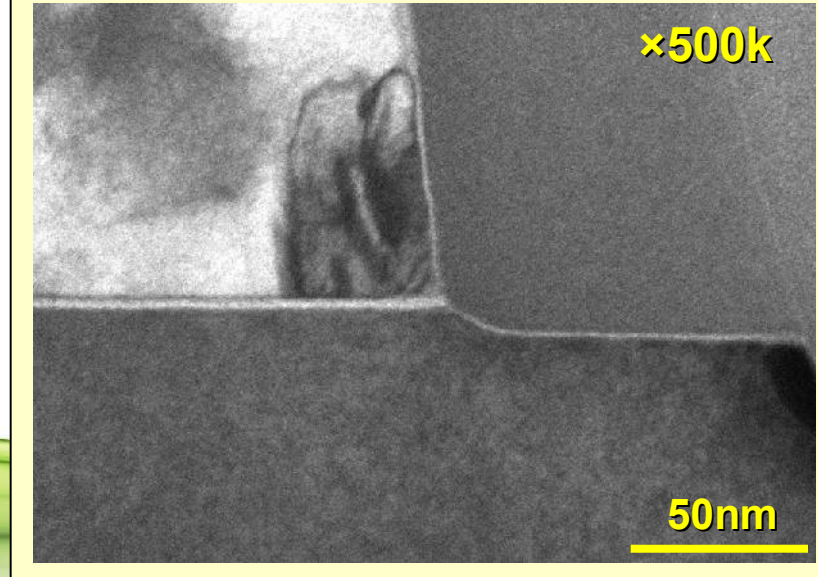
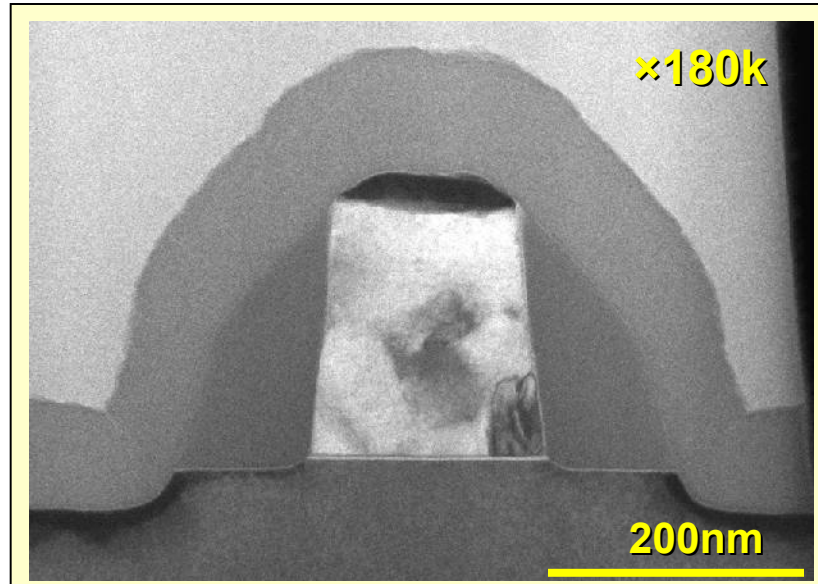


# Application of Failure analysis for Semiconductor

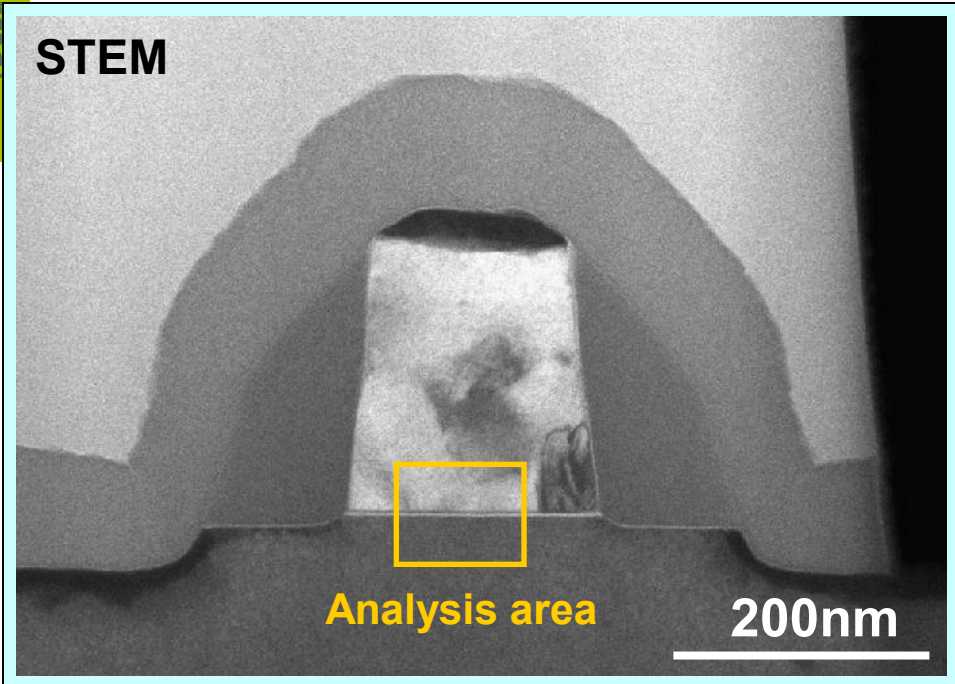
Epaisseur : 220nm



Epaisseur : 100nm



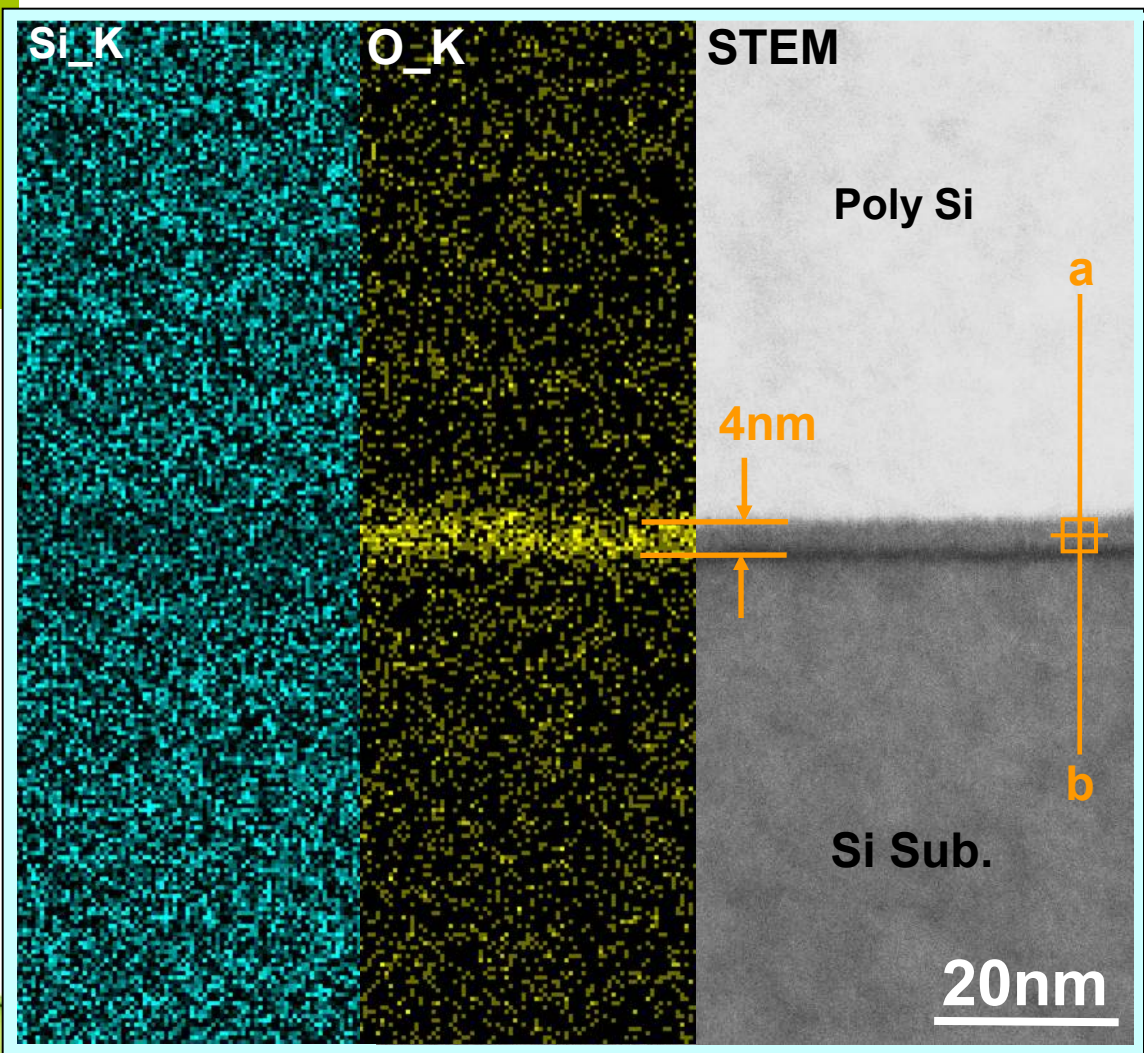
# EDX Analysis



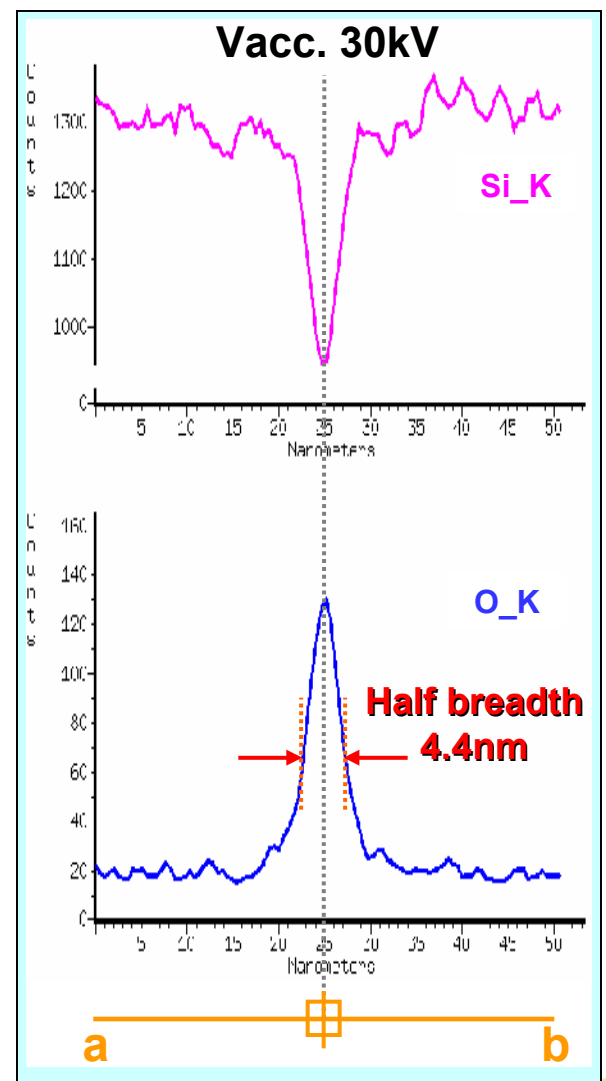
Epaisseur : 100nm  
Vacc : 30kV  
Grandissement : 180k

Echantillon : SRAM MOS transistor  
( SiO<sub>2</sub> oxide film )  
Grandissement : 1000k  
Cartographies : Si\_K / O\_K  
( environ 30min )  
Lignes de profil : Si\_K / O\_K  
( environ 3min )

### Cartographies X



### Lignes de profils



Grandissement : 1 million

# Merci

