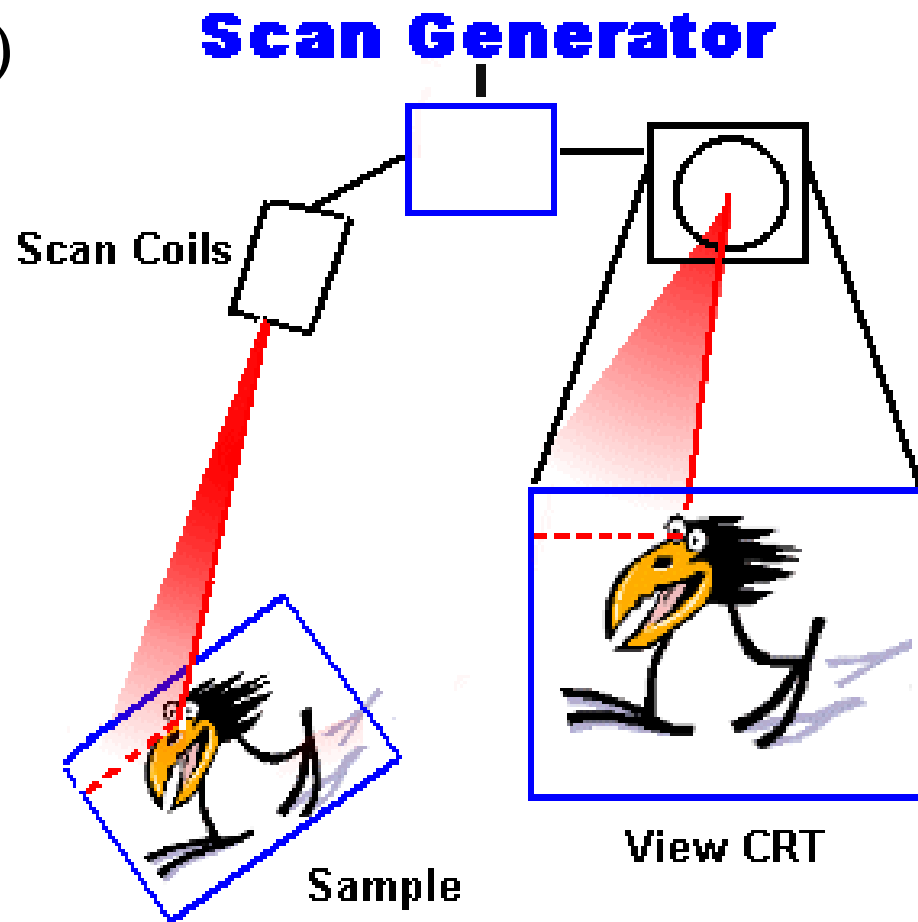


# Scanning Electron microscopy (SEM)

# Scanning electron microscope (SEM)

- Well-focused (0.5-50 nm) electron beam
- Synchronized scanning on the surface of the sample and on the screen
- Image formation: the brightness of the points of the screen is modulated by the intensity of the response signals from the specimen

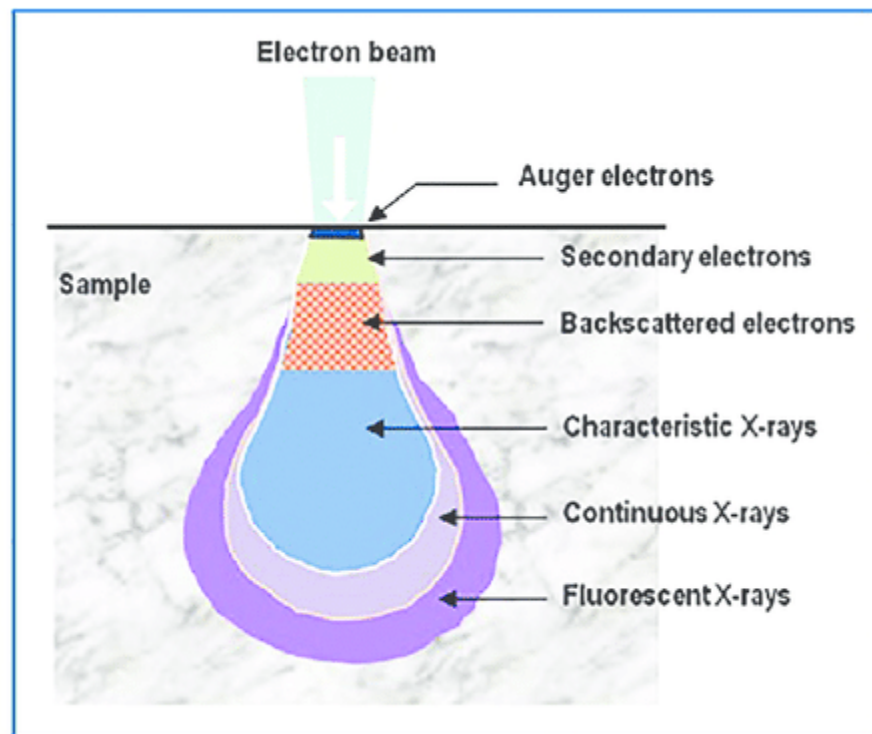
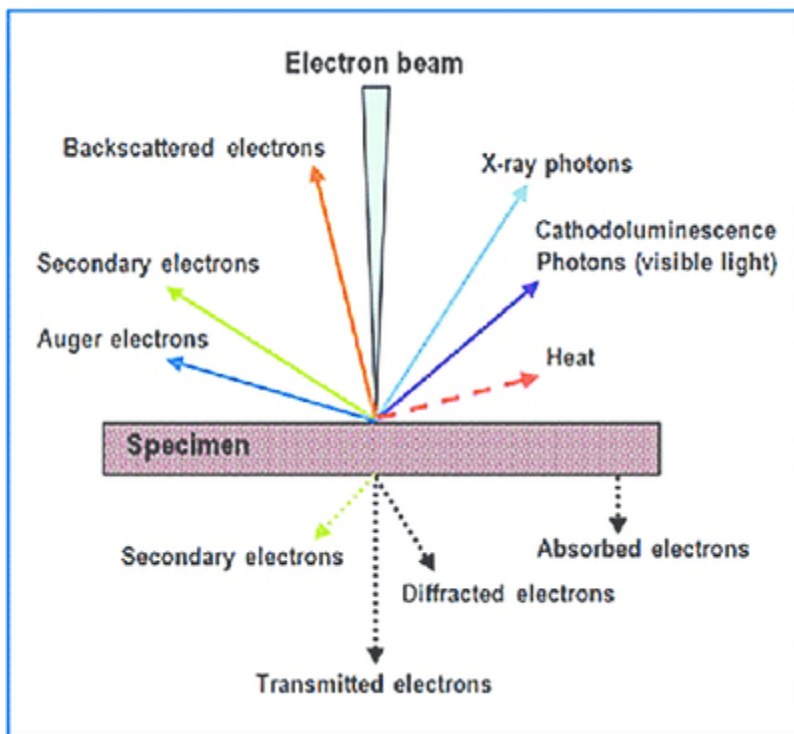
# Scanning electron microscope (SEM)



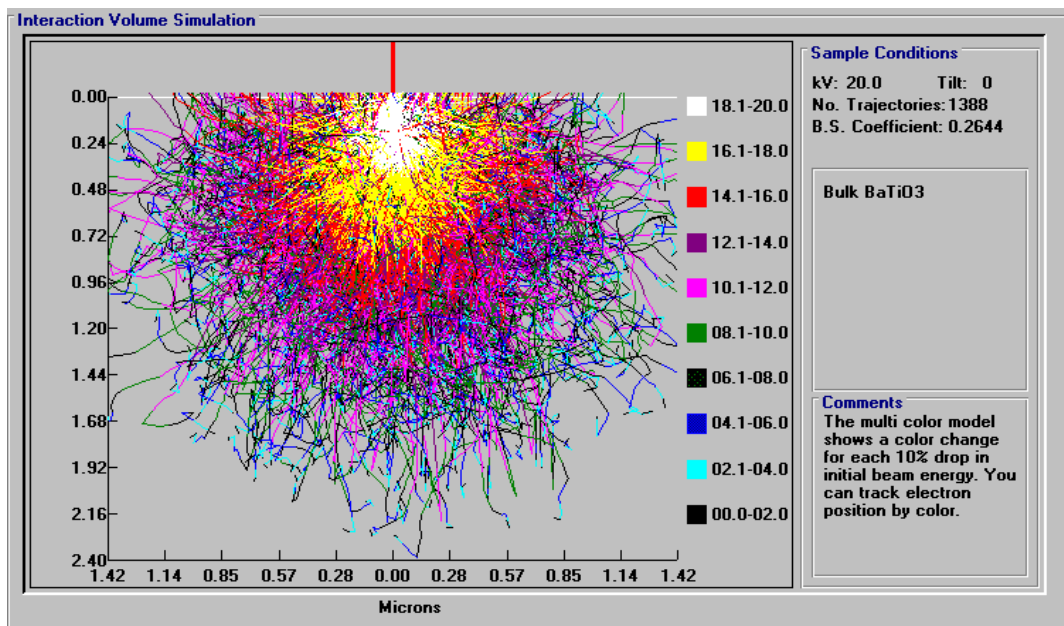
# Response signals

- Back scattered electrons
- Secondary electrons
- Characteristic X-ray radiation
- Light
- Heat
- Specimen current

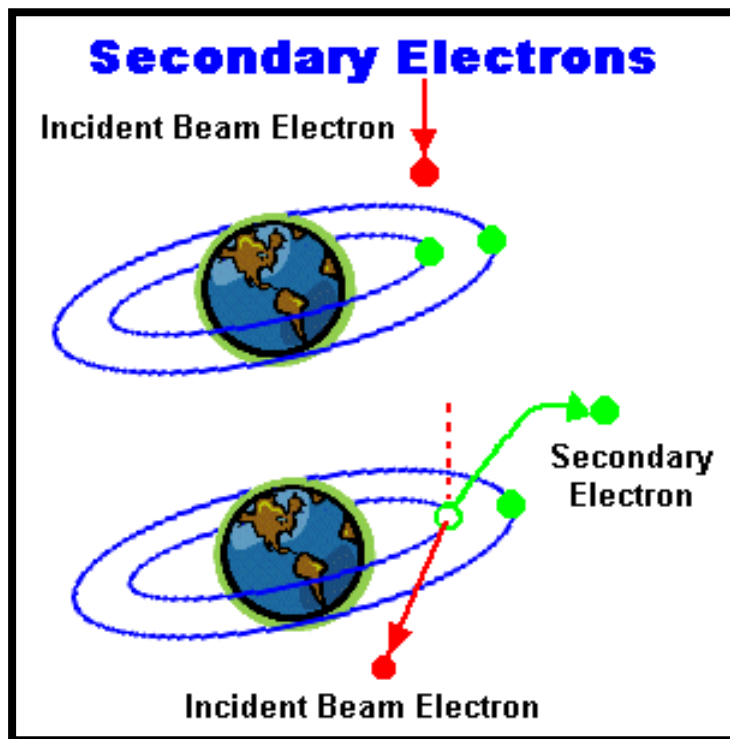
# Specimen-beam interaction



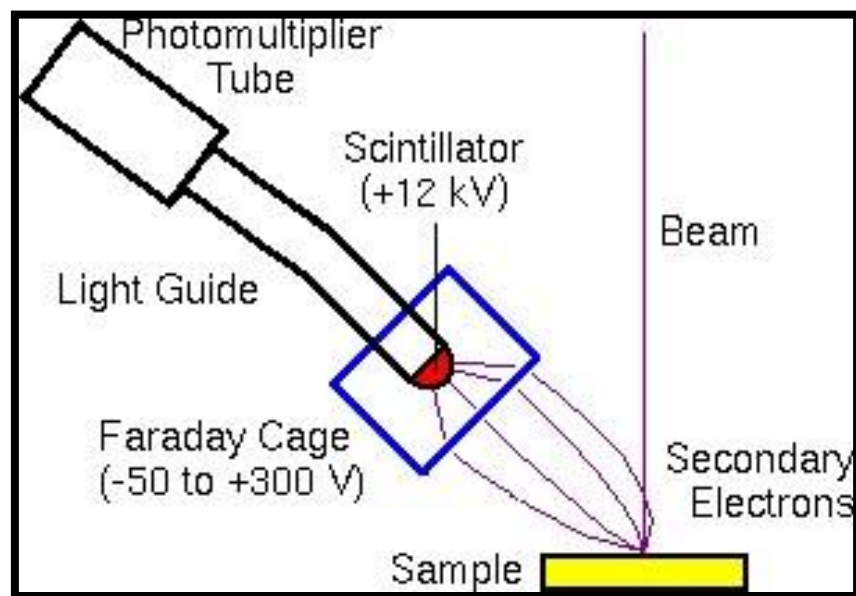
# Monte Carlo simulation



# Secondary electrons

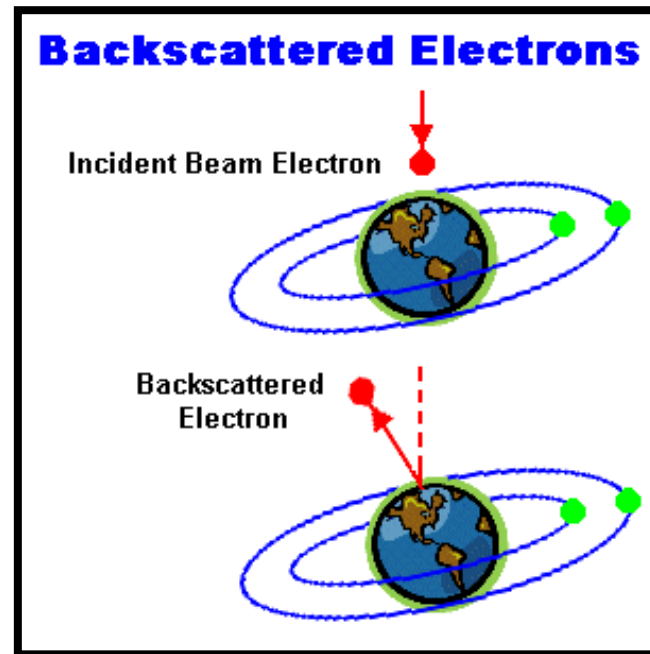


# Detection of secondary electrons

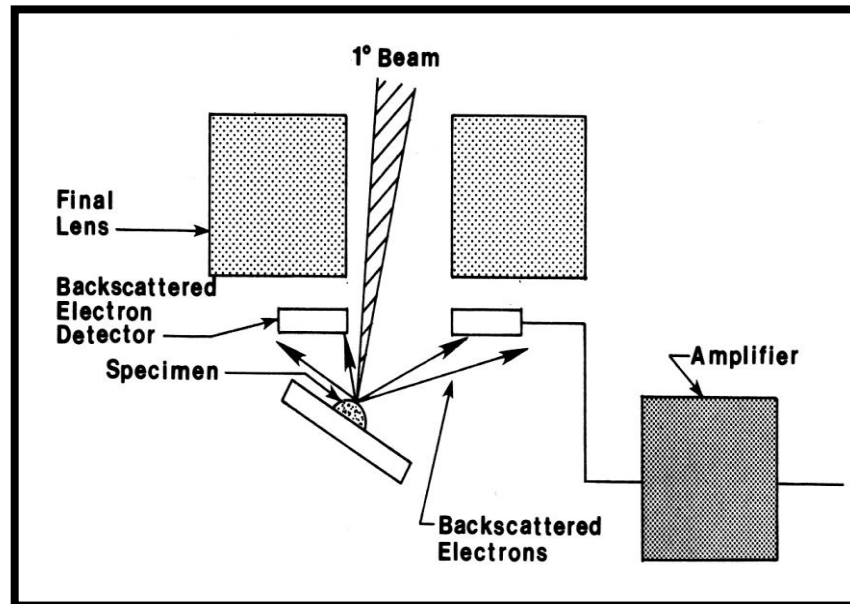




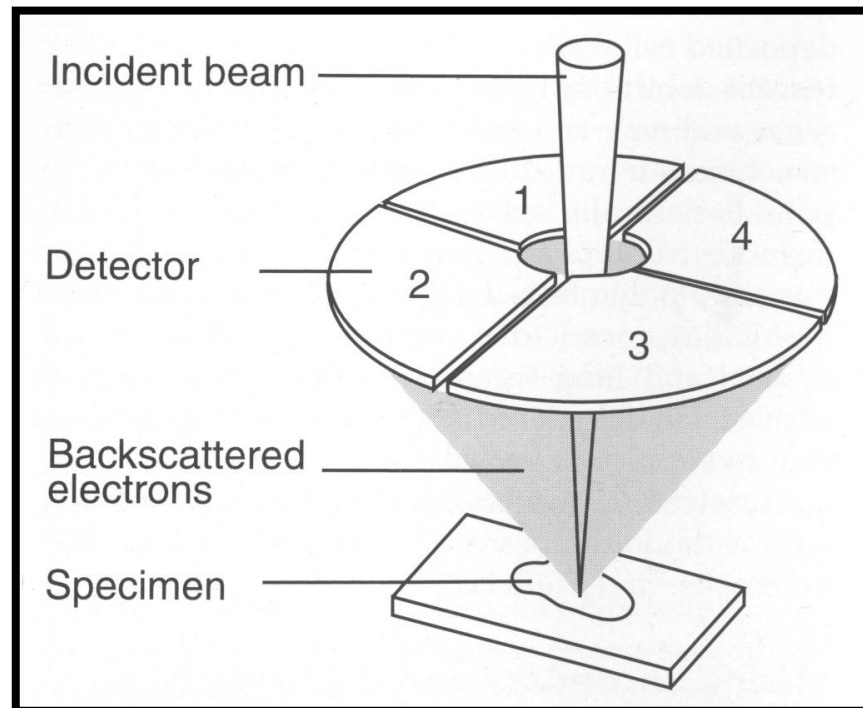
# Backscattered electrons



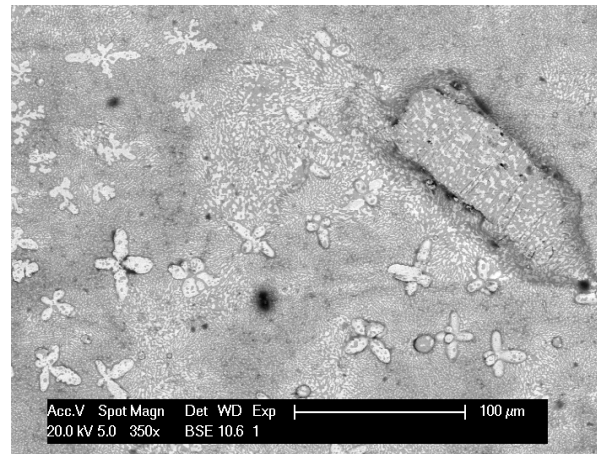
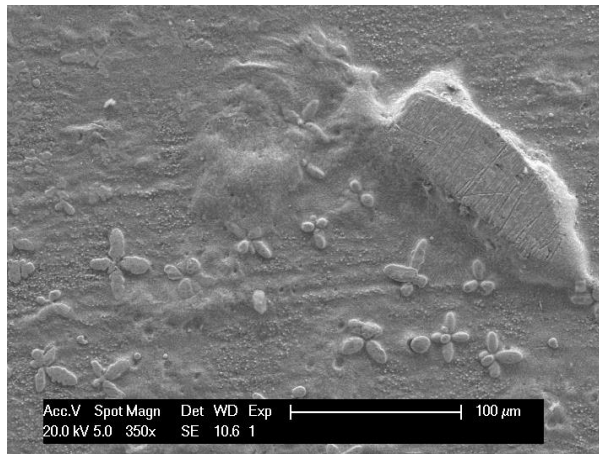
# Detection of backscattered electrons



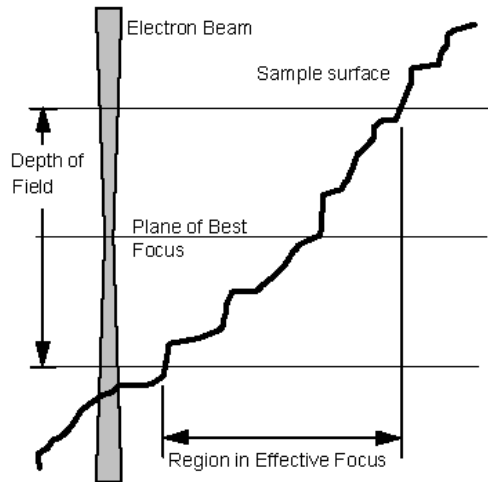
# Detection of backscattered electrons



# SE vs. BSE



# Depth of focus



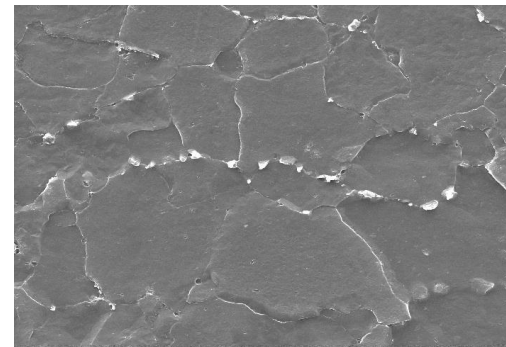
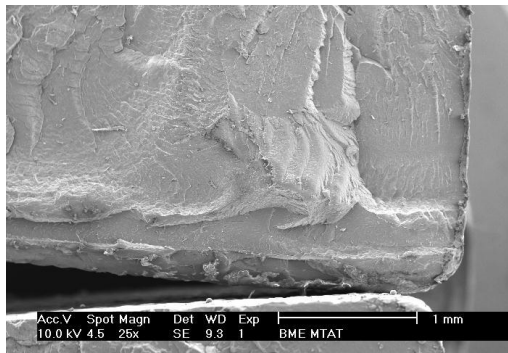
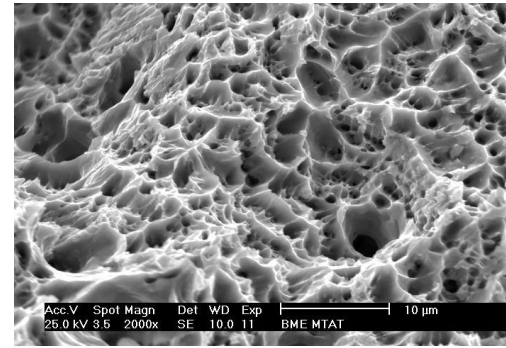
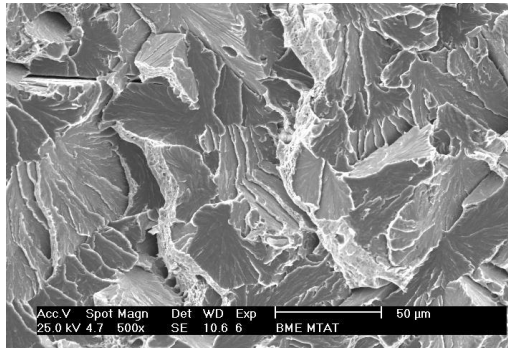
# Vacuum

- Deposition of carbohydrogenes
- ionozation of gas moleculas – cathode damage
- Sputtering

## Charging, covering by metallic layer

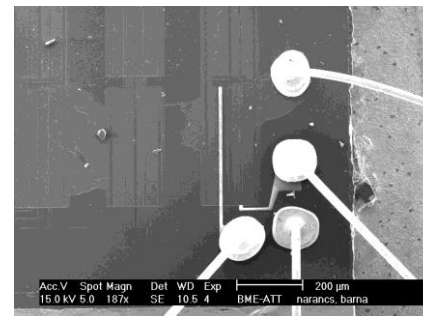
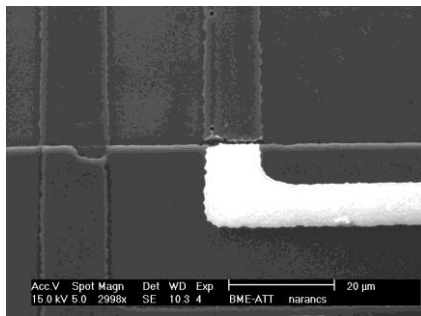
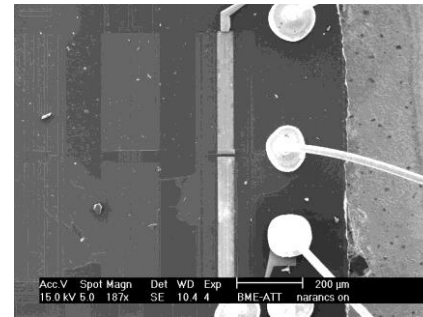
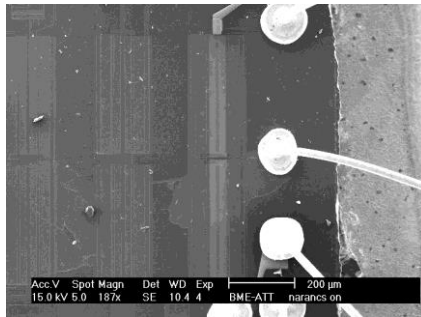
- Samples which do not conduct electric current will charge
- Covering by thin metallic layer (Au, Ag, Pd)
- Carbon evaporation

# SEM-examinations

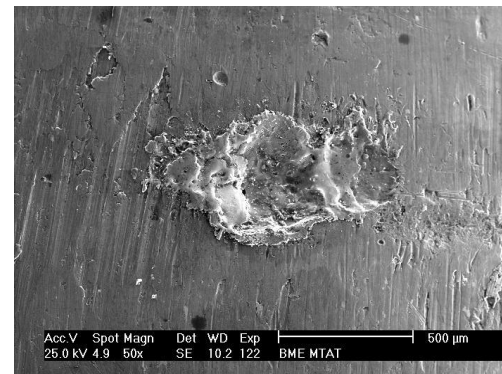
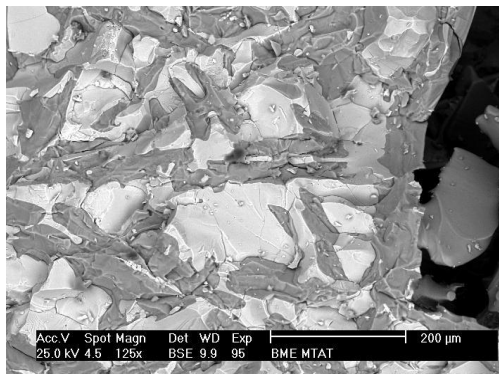
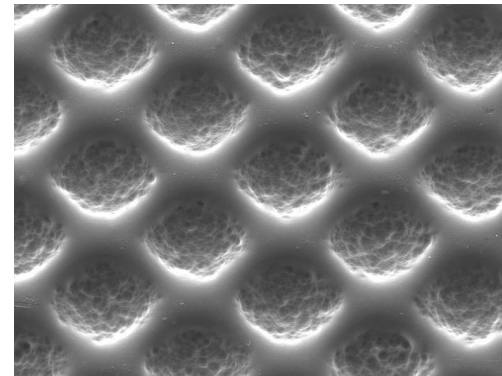
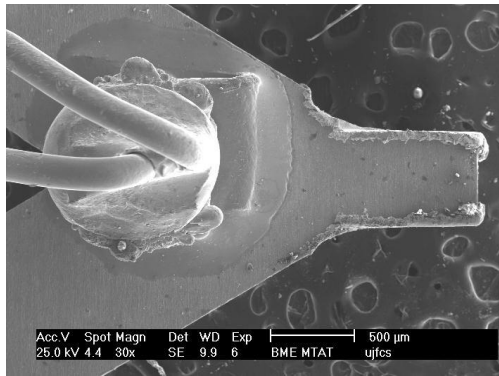




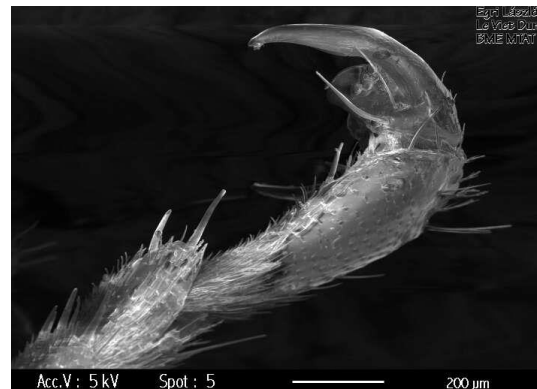
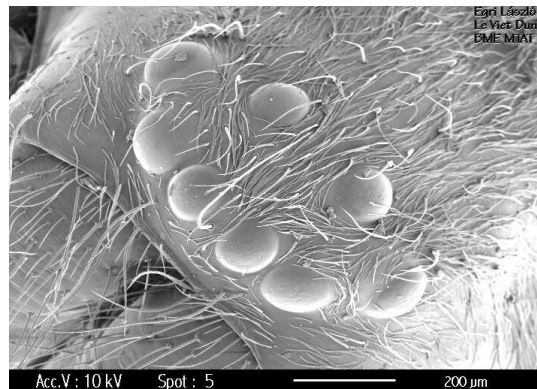
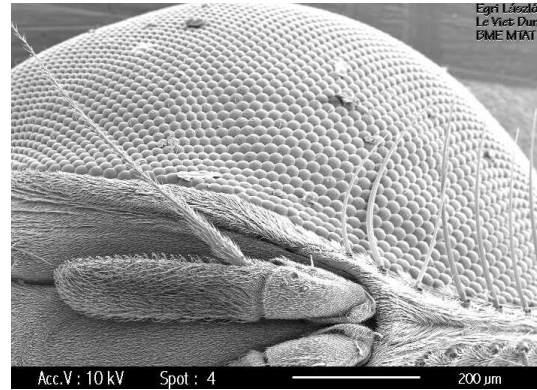
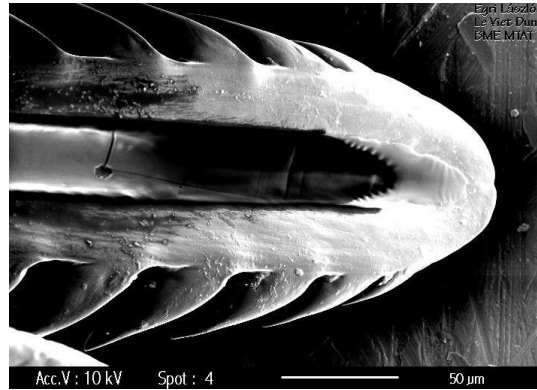
# SEM-examinations



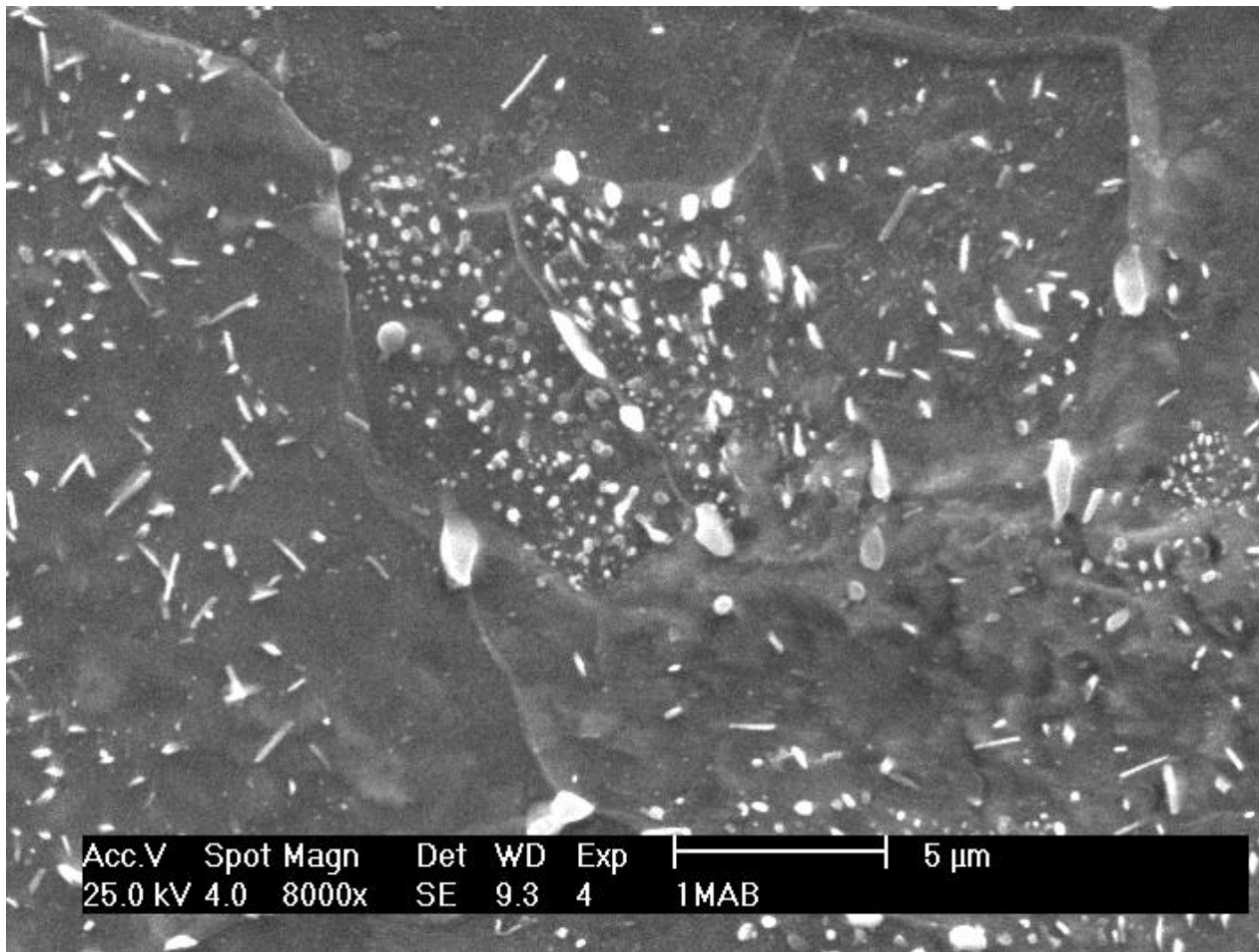
# SEM-examinations



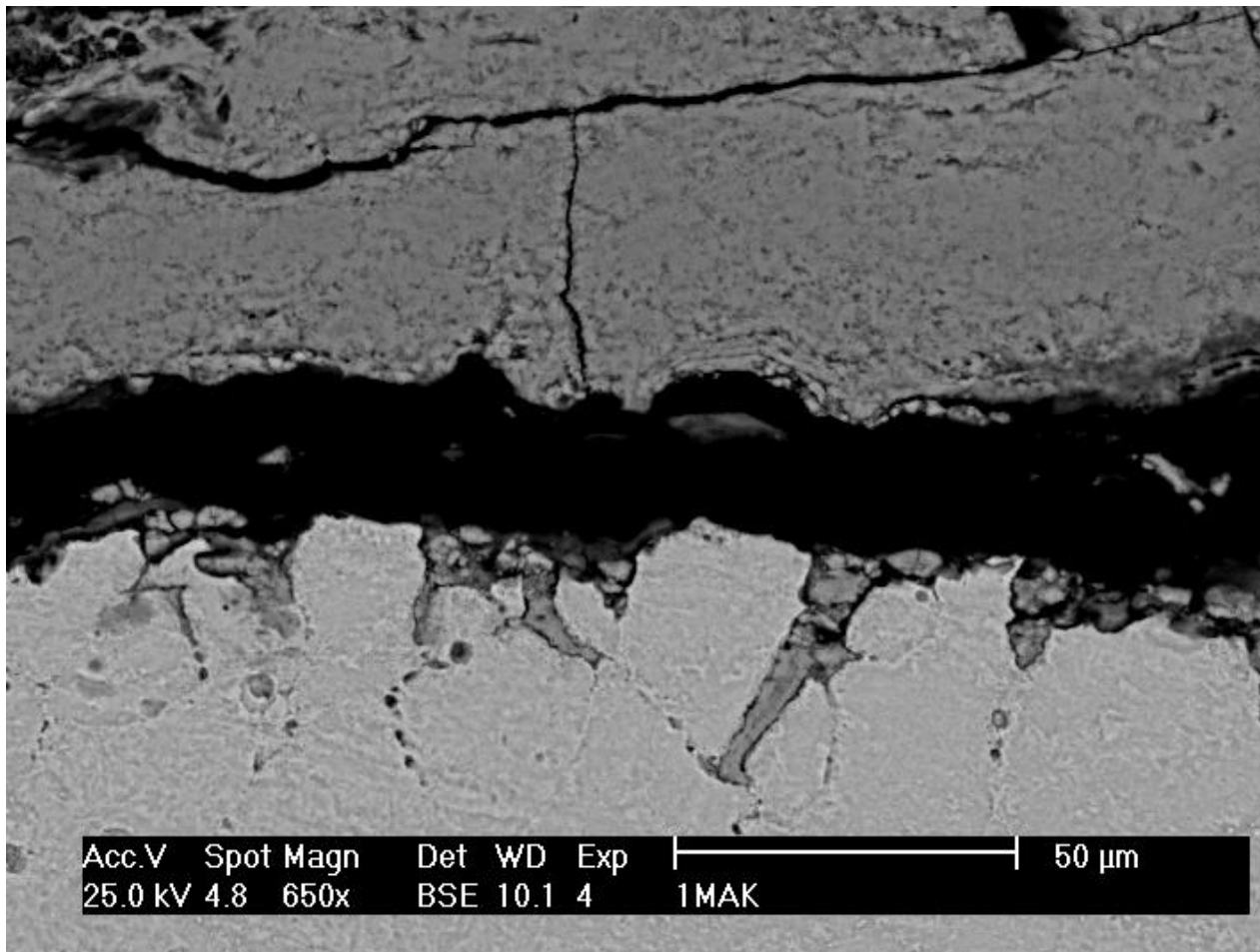
# SEM-examinations



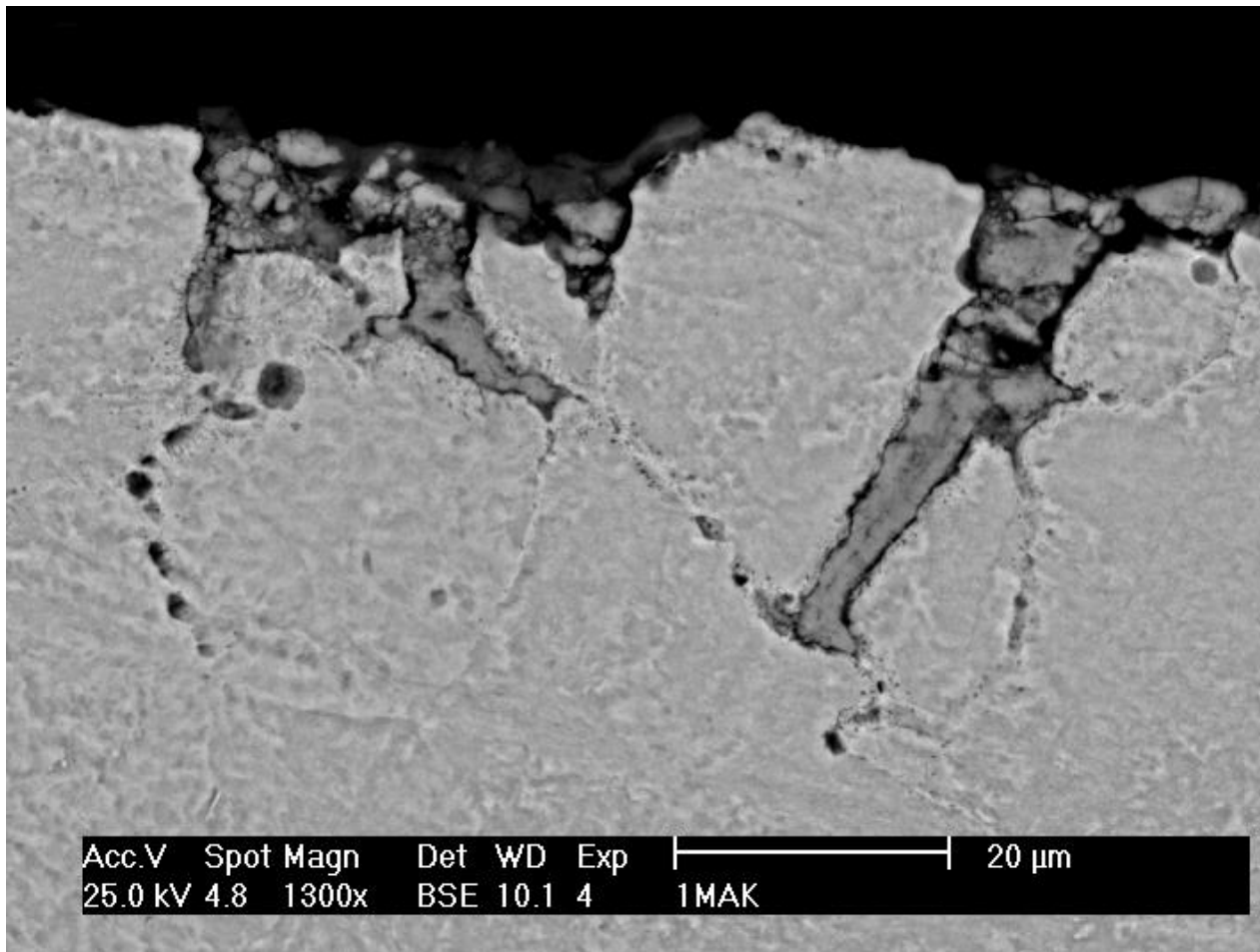
# Carbides



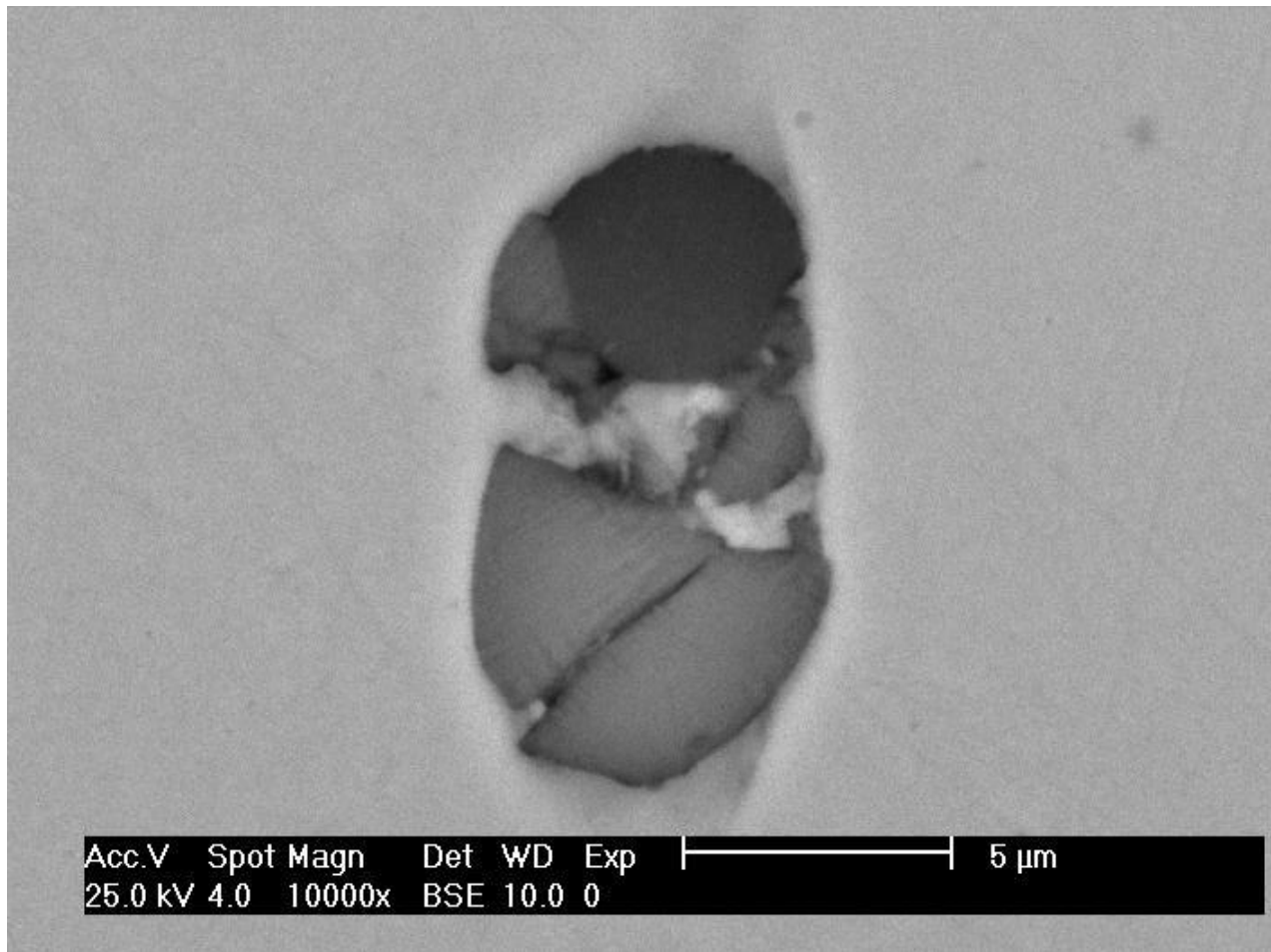
# Surface oxidation of steel



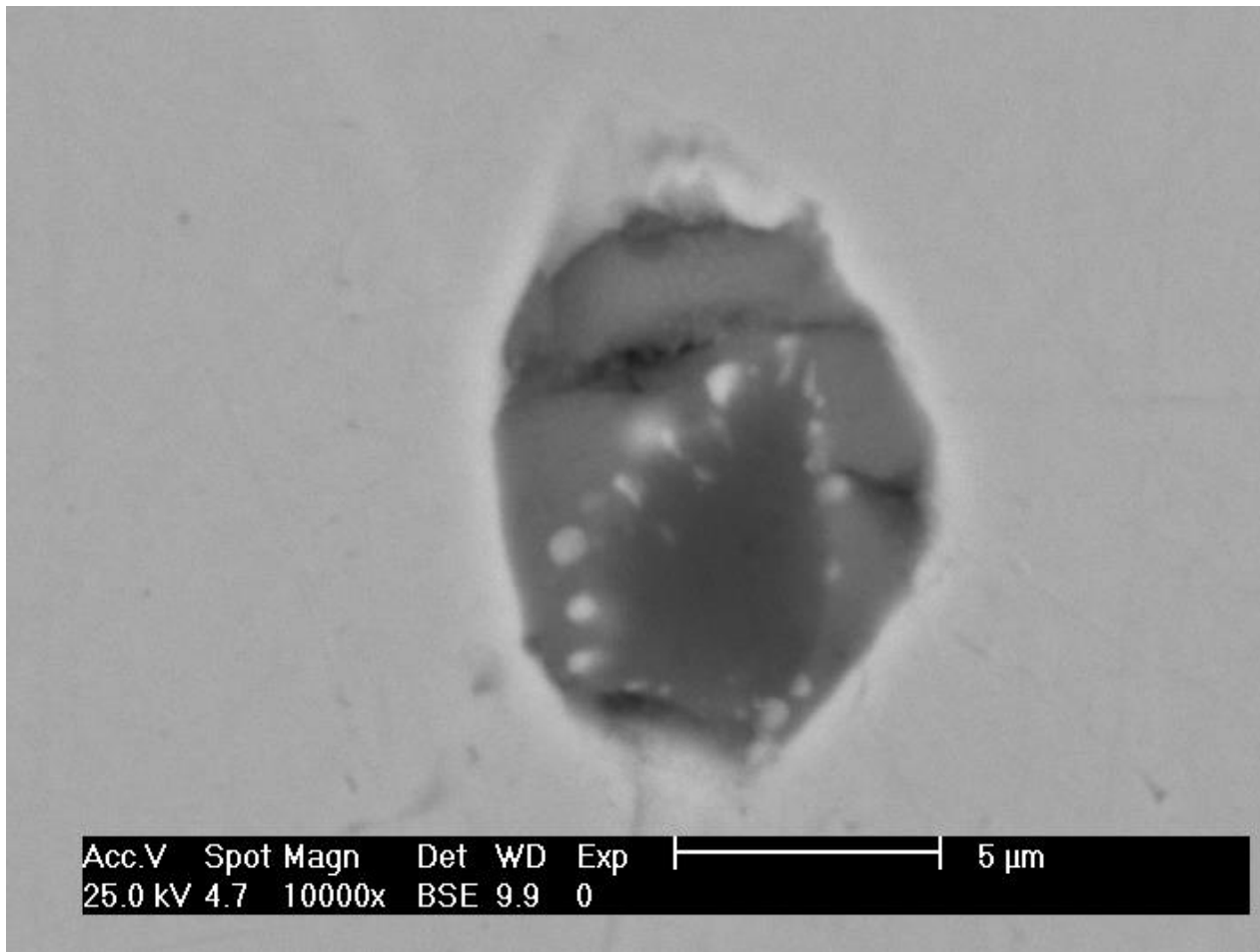
# Surface oxidation of steel



# Inclusion in steel

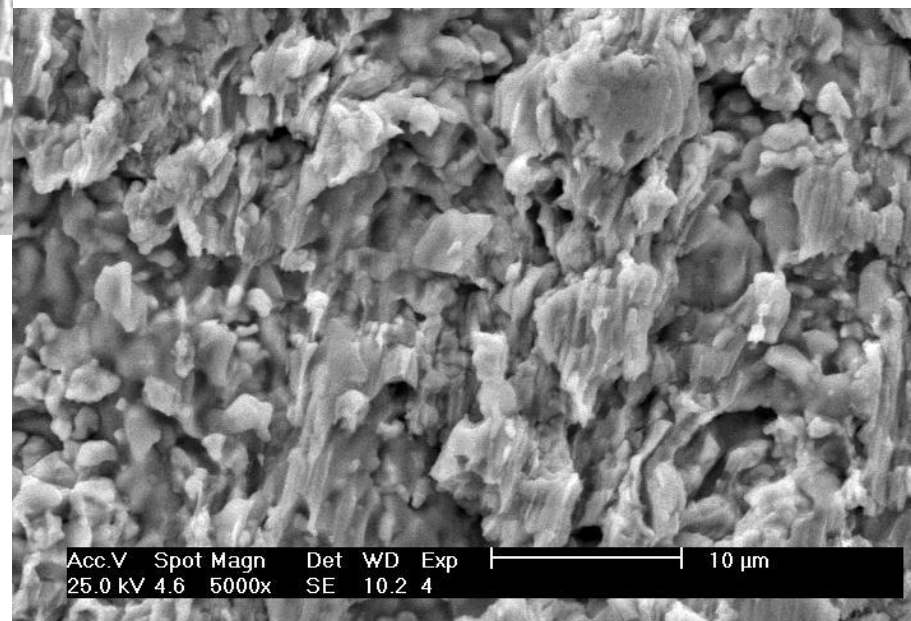
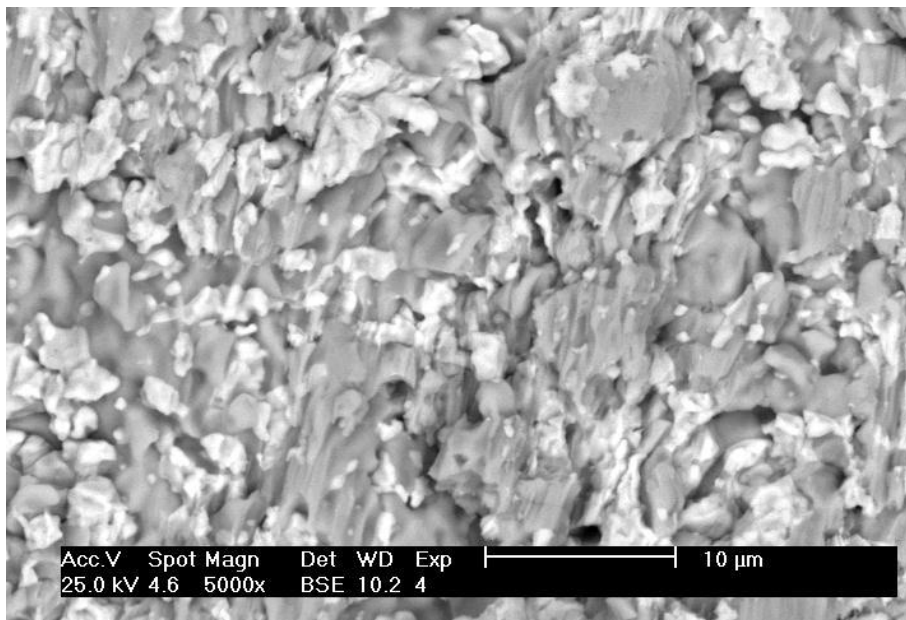


# Inclusion in steel

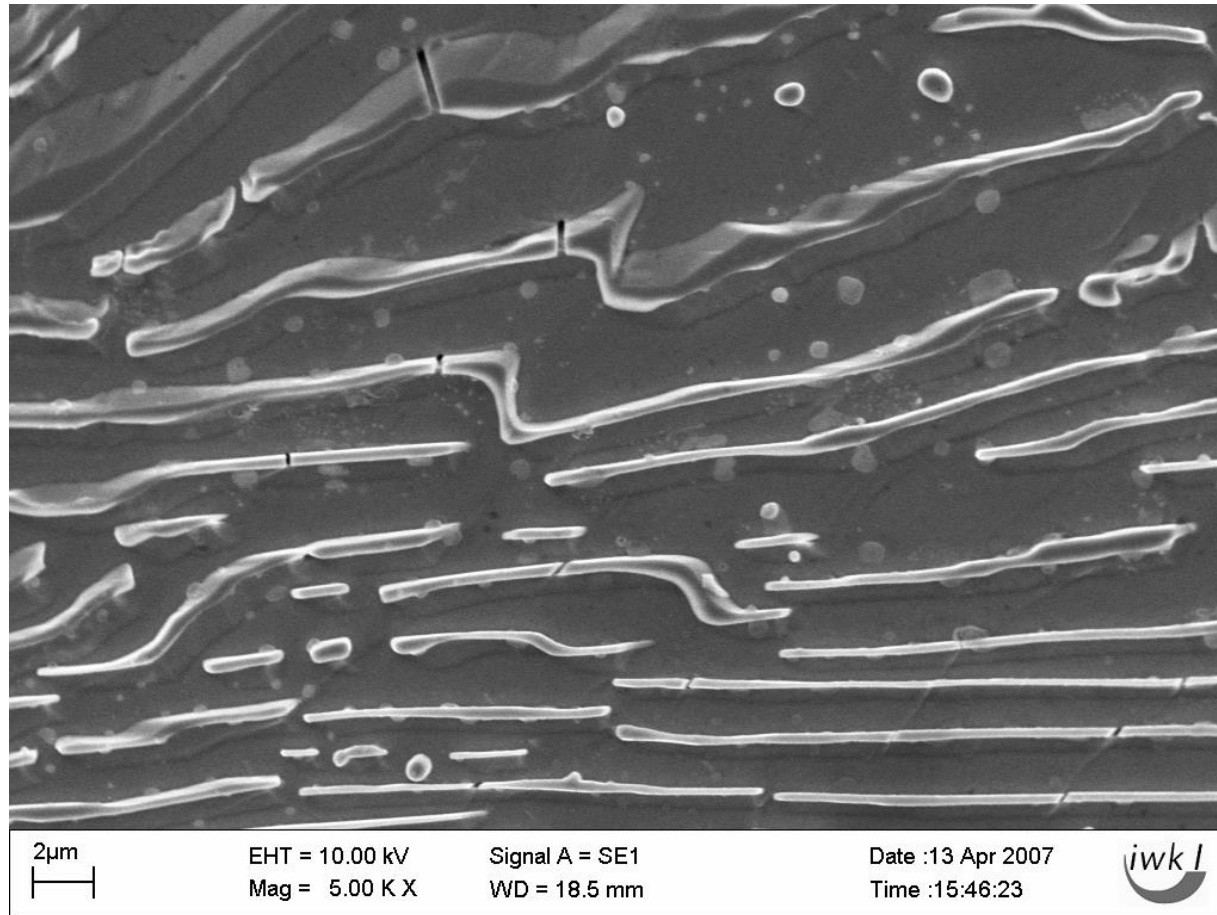




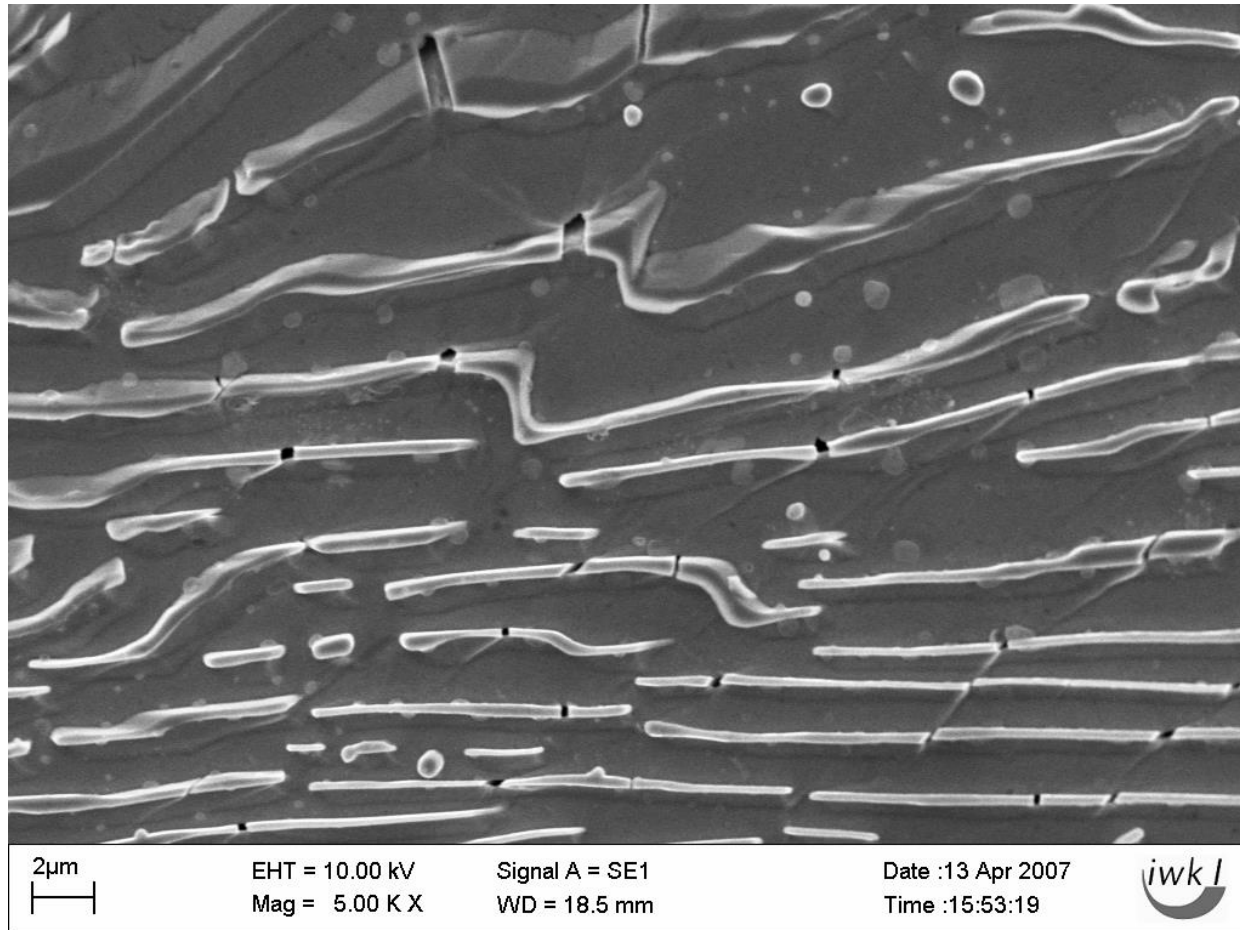
# Fractured surface SE - BSE



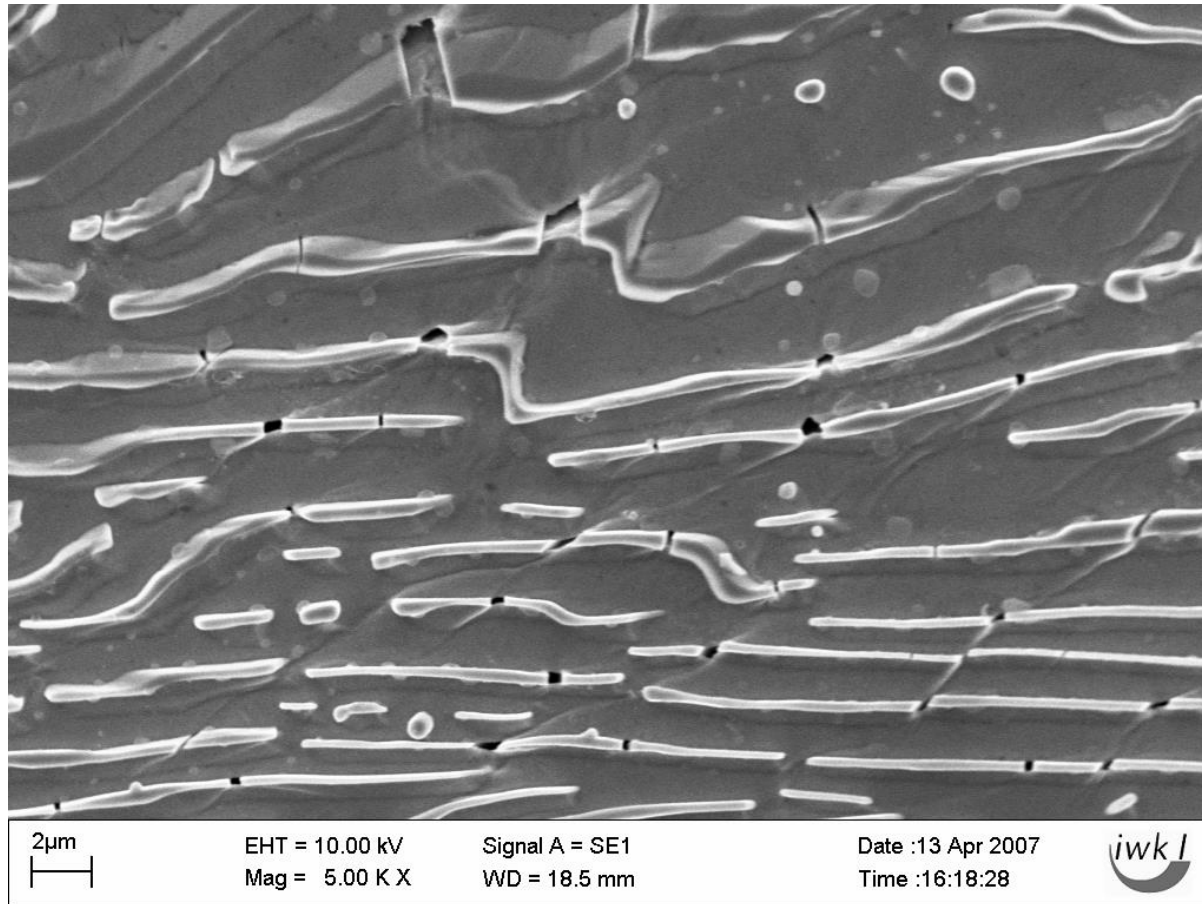
# Fracture in-situ



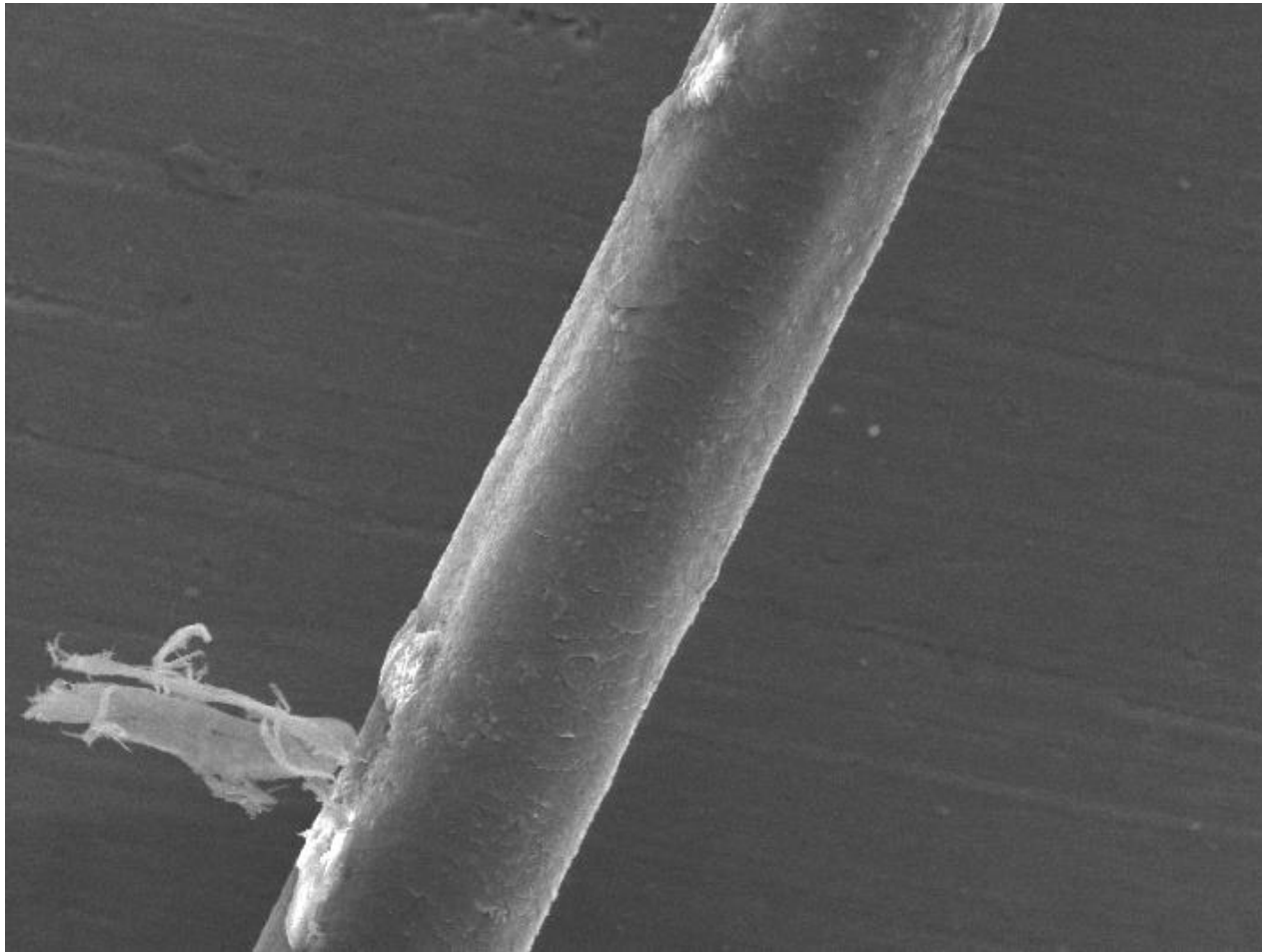
# Fracture in-situ



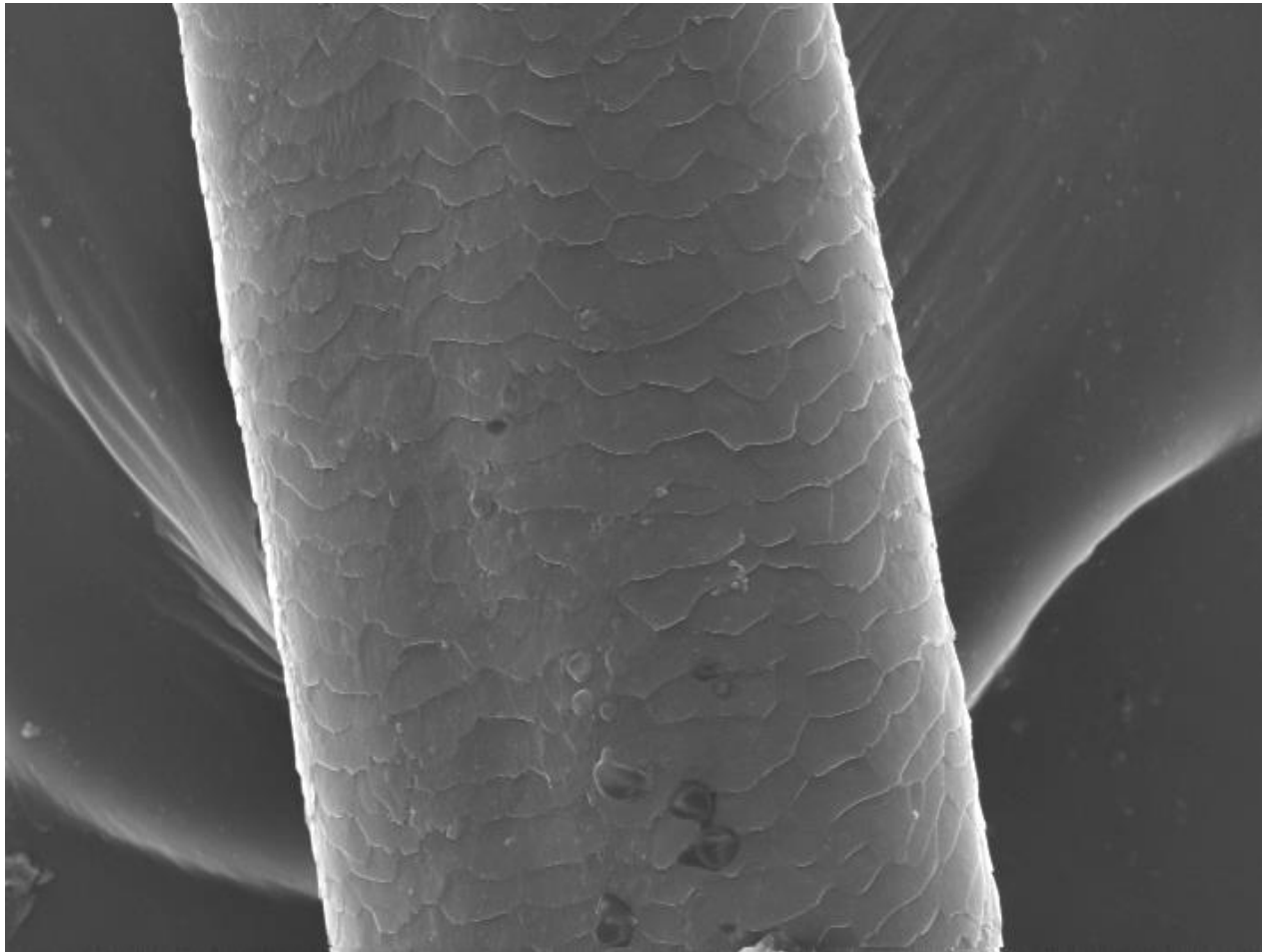
# Fracture in-situ



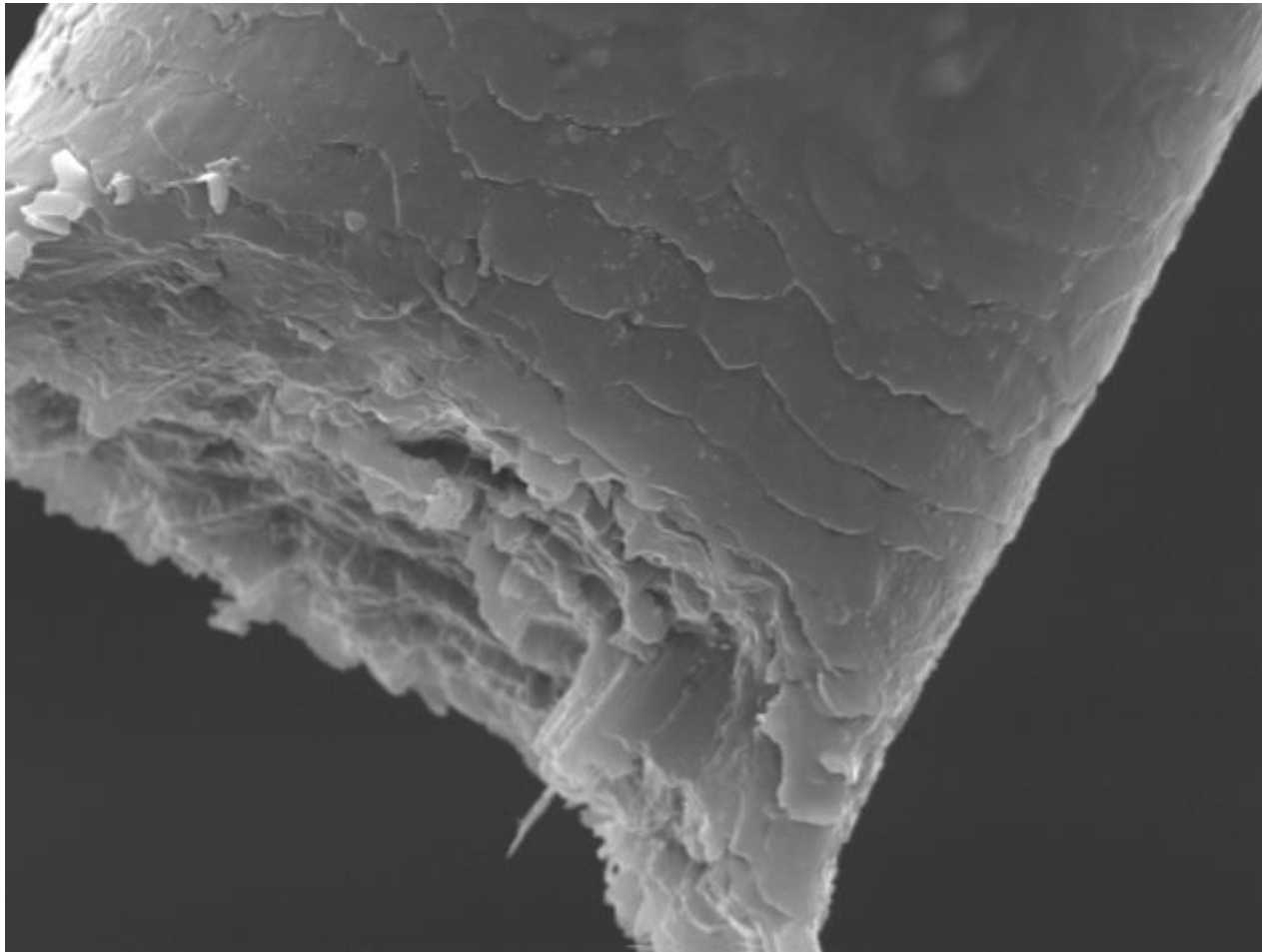
# Human hair



# Human hair



# Human hair



# Tungsten spiral

