

In situ monitoring the effect of corrosion on the surface morphology of crystalline silicon

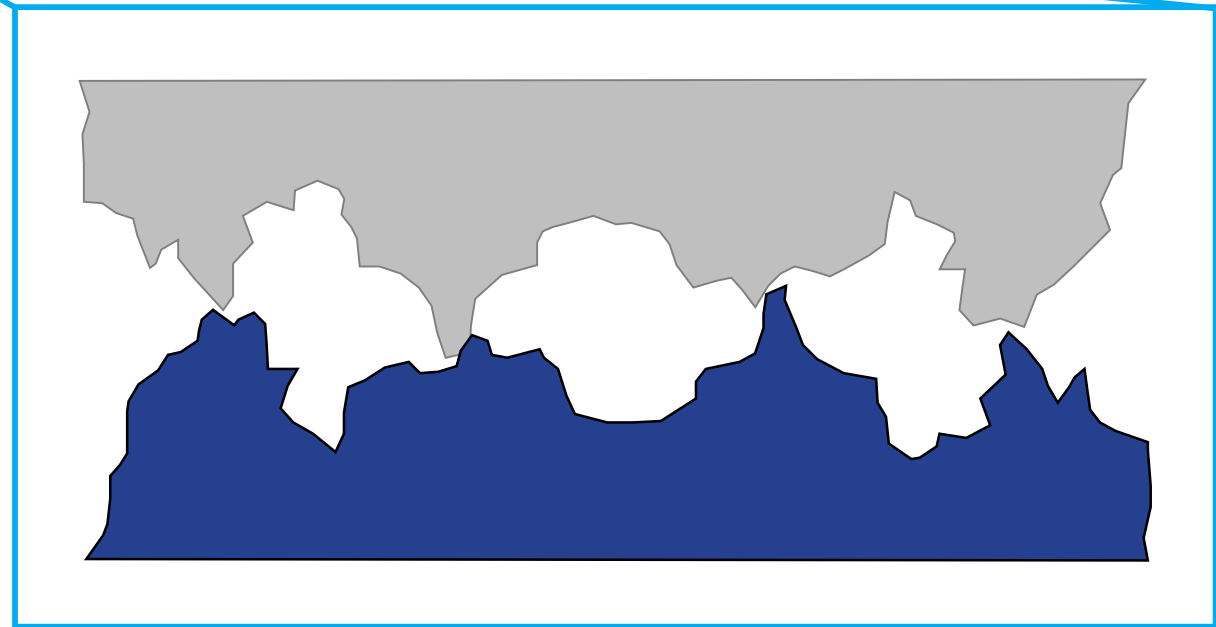
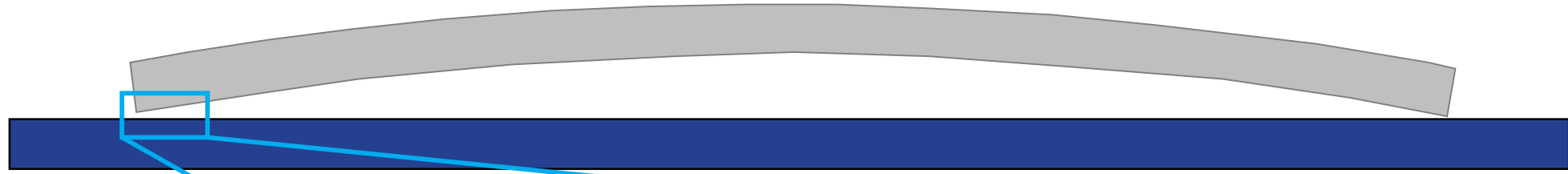
EUV Source Workshop 2019
4th November 2019

Contact Dynamics
Fiona Elam



ADVANCED RESEARCH CENTER FOR NANOLITHOGRAPHY

Tribology



Temperature

Humidity

Atmosphere

Lubricant

Sliding speed and mode

Materials

Coatings

Surface roughness

Contact area

Oxidation/corrosion

Fundamental understanding

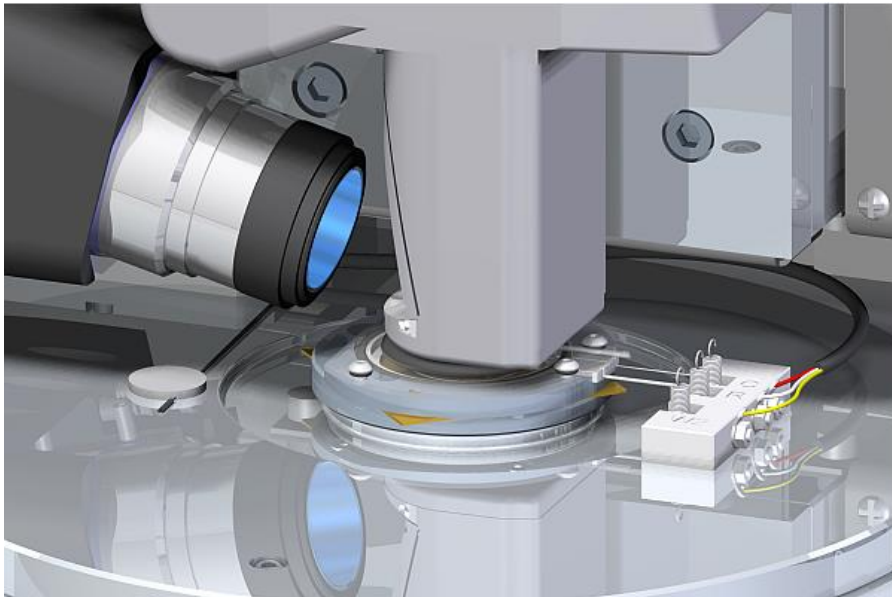


Manipulation

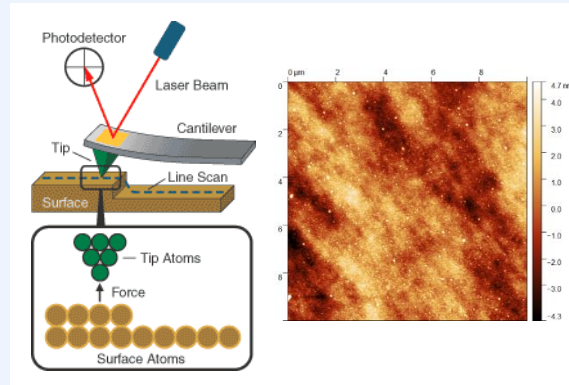
How can corrosion be measured?

- Perform electrochemical measurements to determine corrosion (oxidation) rates
- Monitor surface morphology evolution
- *In-situ*

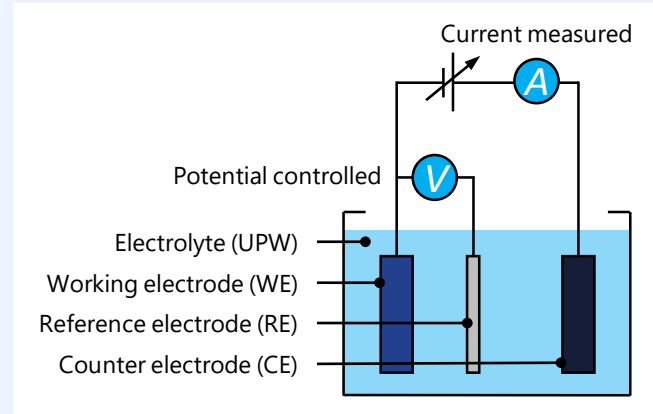
Electrochemical atomic force microscopy (EC-AFM)



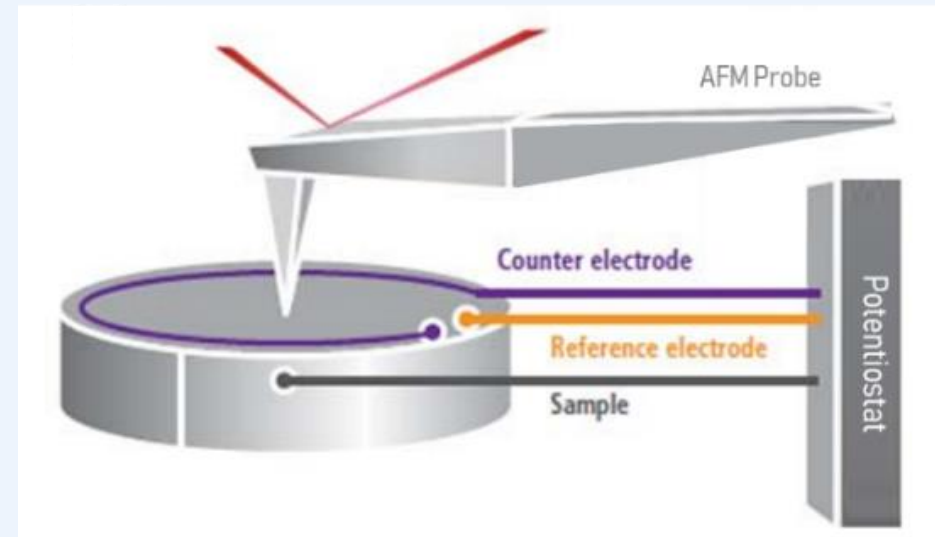
Atomic force microscope



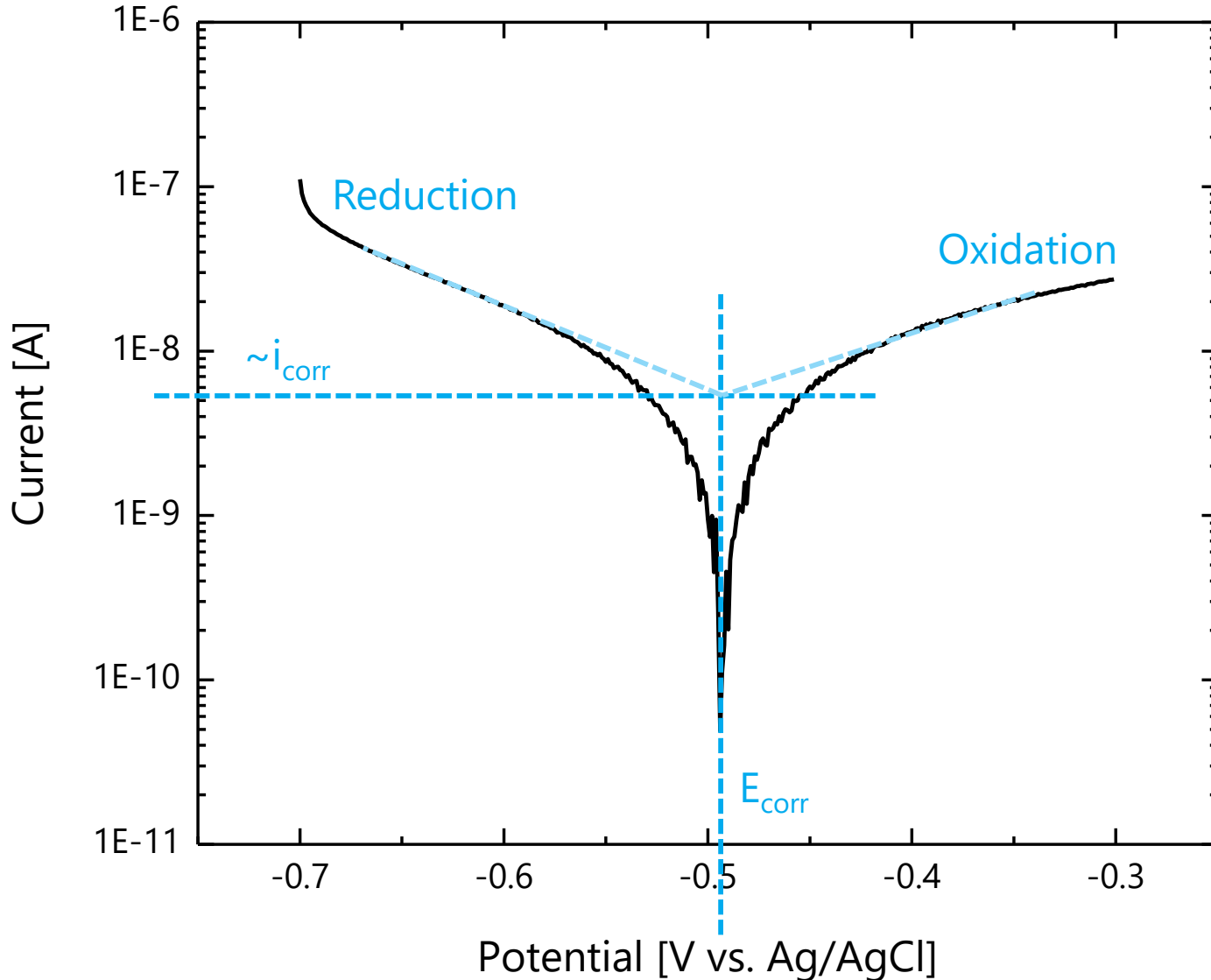
Three electrode electrochemical cell



EC-AFM



Measuring corrosion: Tafel plot



Reduction: $M^{n+}(\text{aq}) + ne^- \rightarrow M(\text{s})$

Oxidation: $M(\text{s}) \rightarrow M^{n+}(\text{aq}) + ne^-$

i_{corr} : Corrosion current \rightarrow Corrosion rate

Materials with higher corrosion current (rate), corrode faster

E_{corr} : Corrosion potential (open circuit potential)

Materials with lower corrosion potential are less thermodynamically stable, higher tendency to corrode

Thank you for your attention