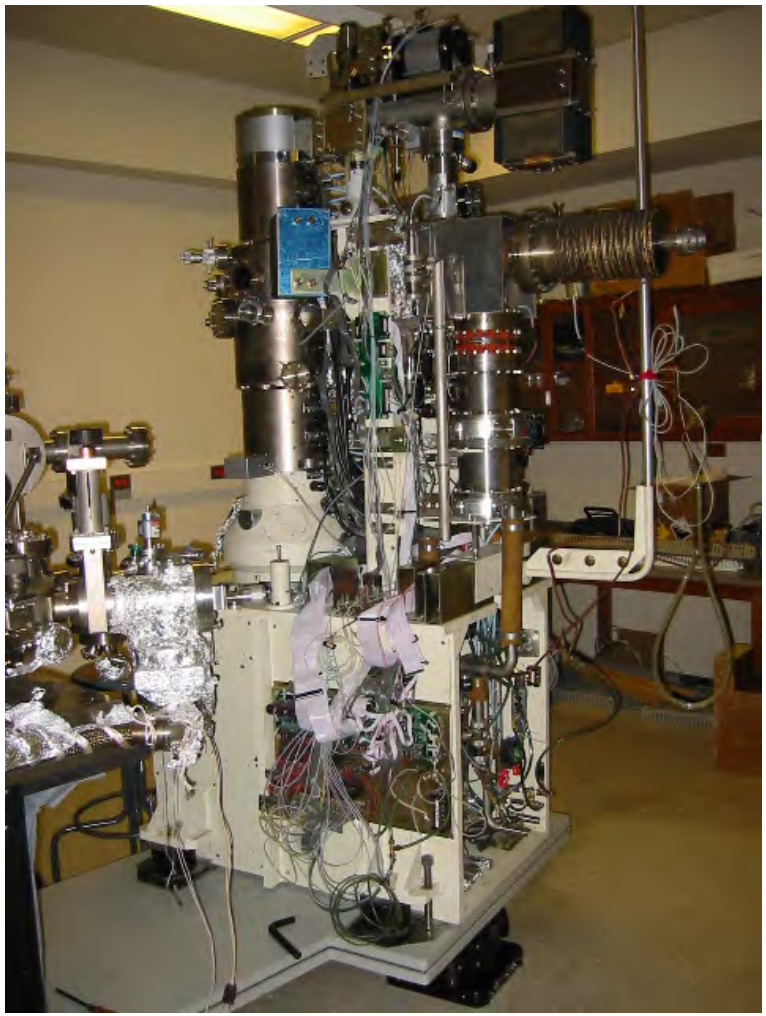
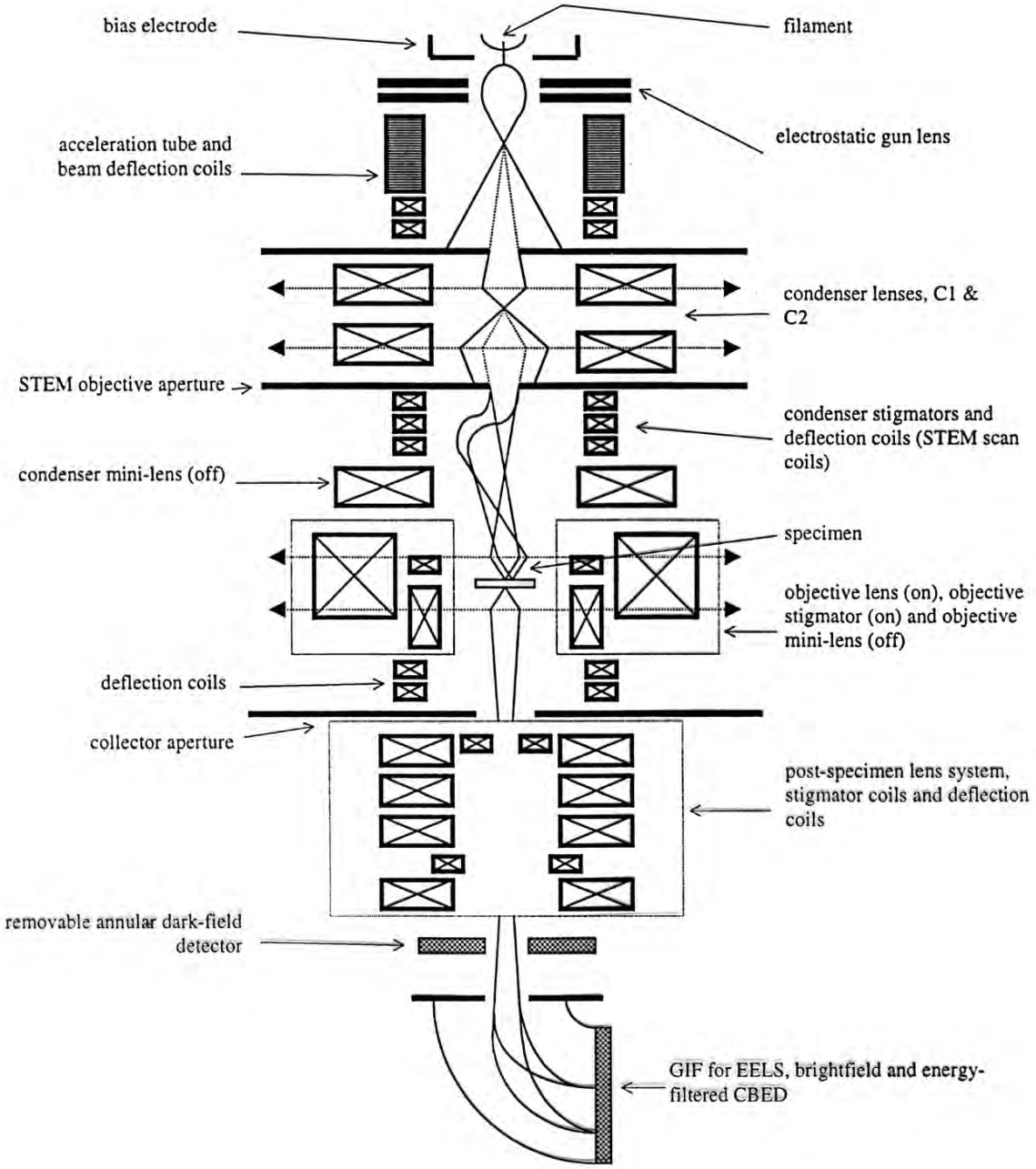
Conventional TEM

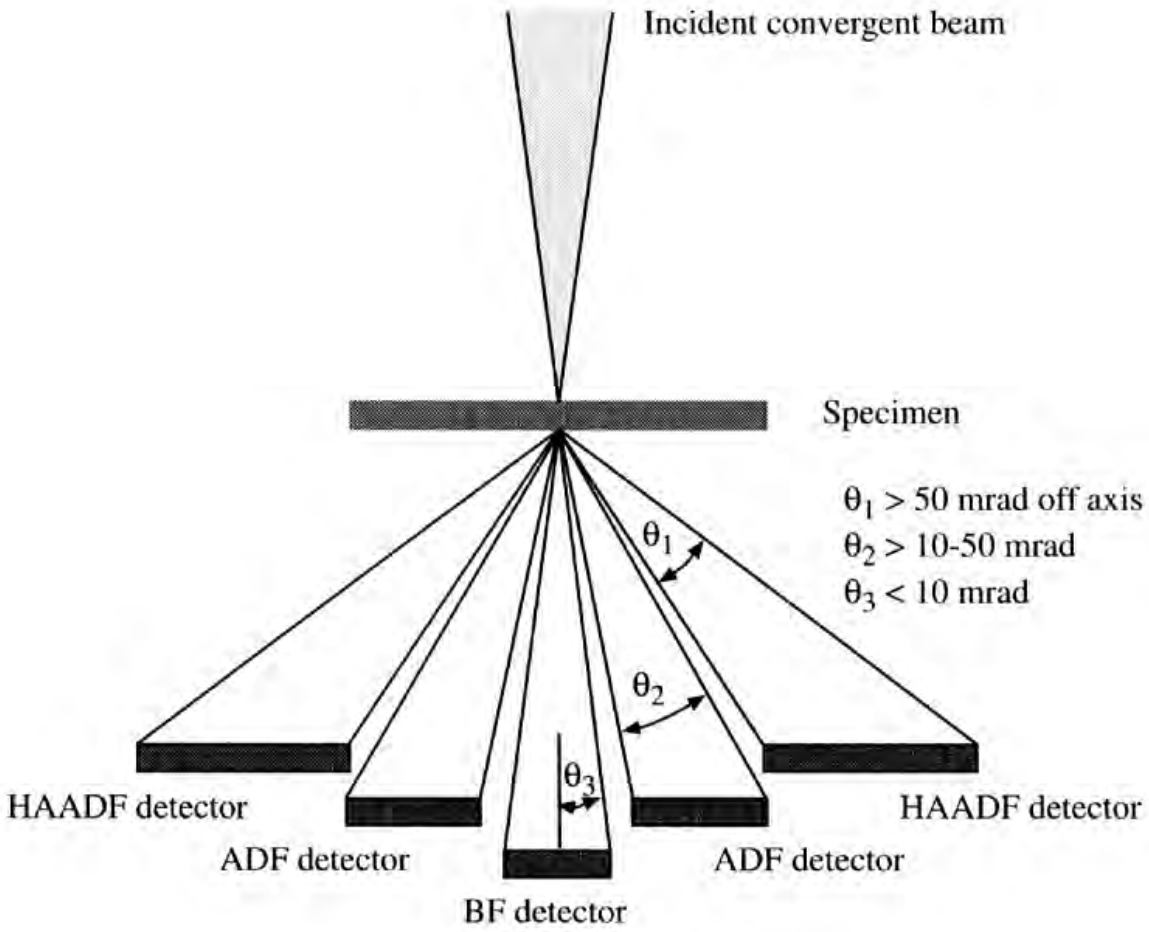


STEM

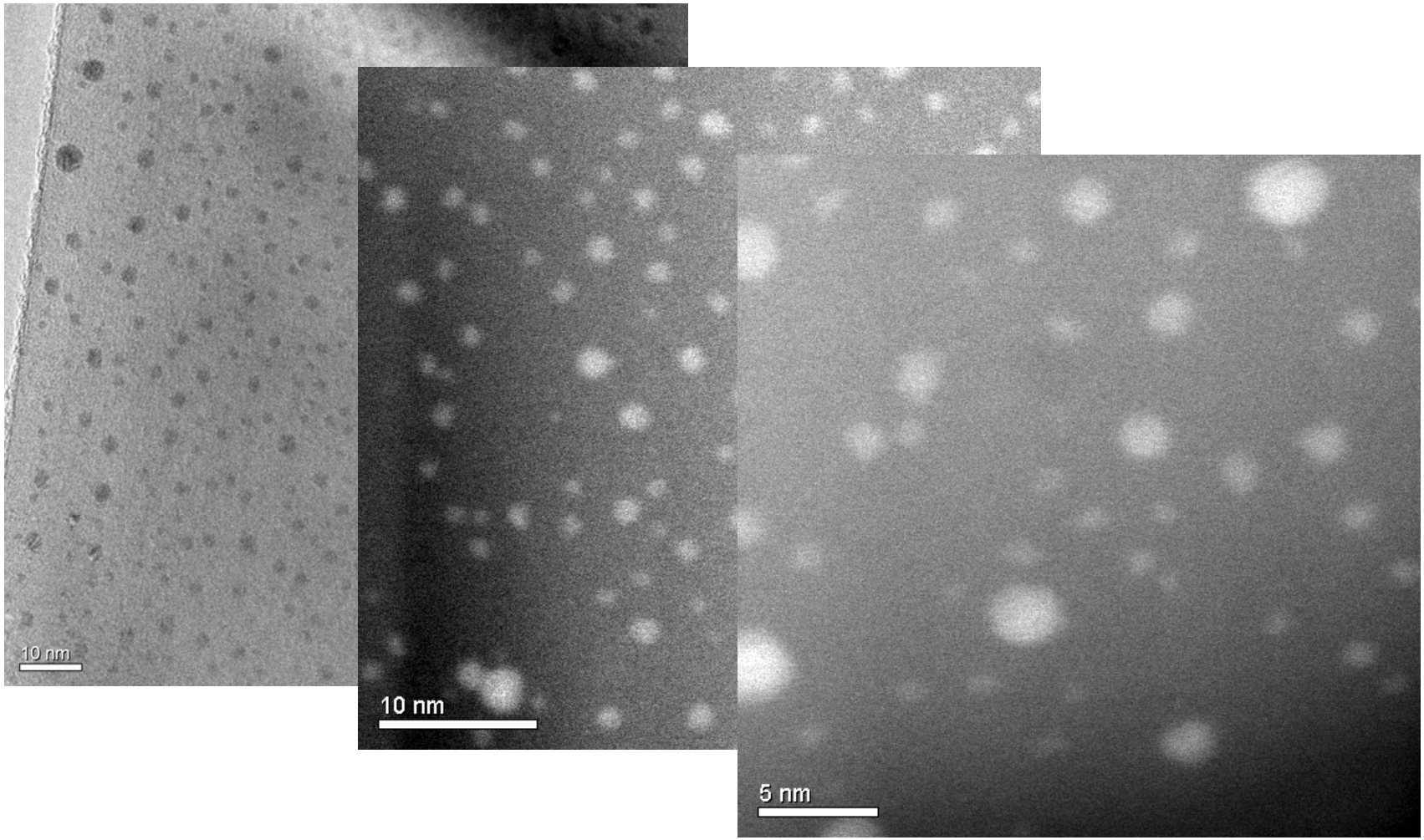


FEG STEM at UIC

Z-contrast STEM Config.

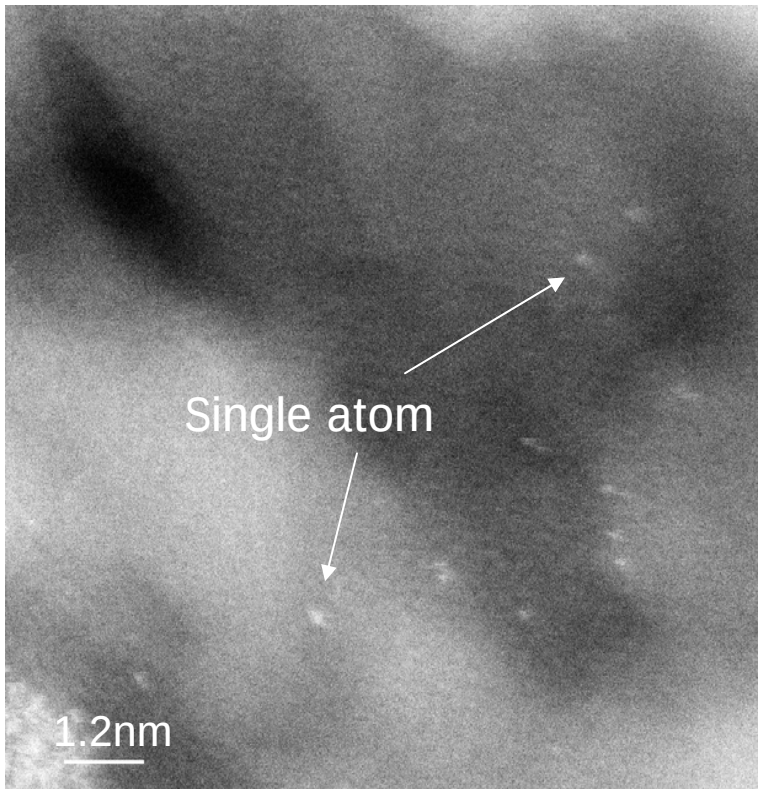


Sample H05: As-Deposit

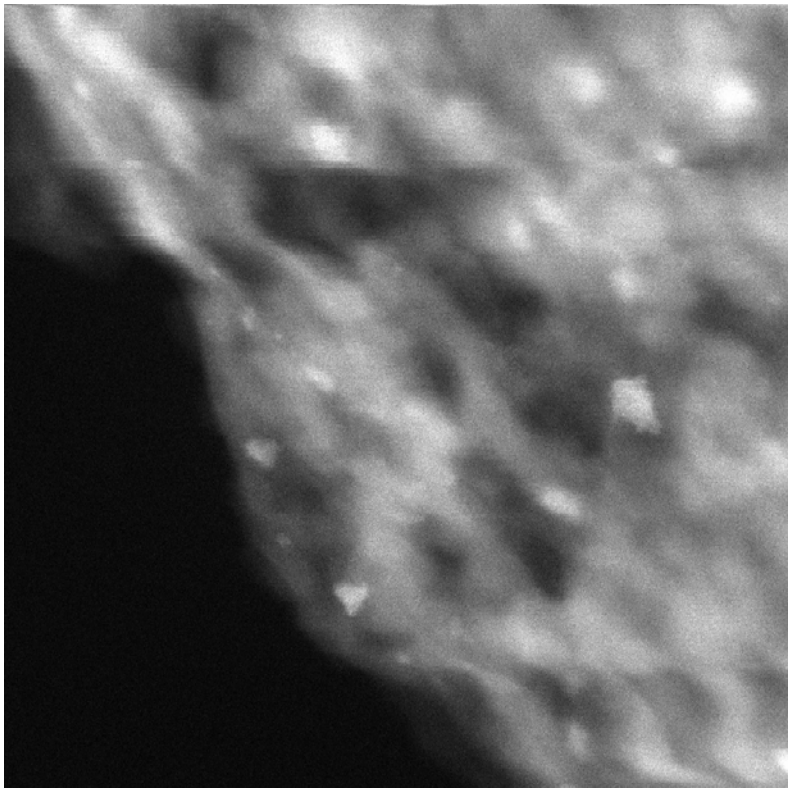


Study of Au Catalyst Structure and Morphology

Activated Au/Al_2O_3



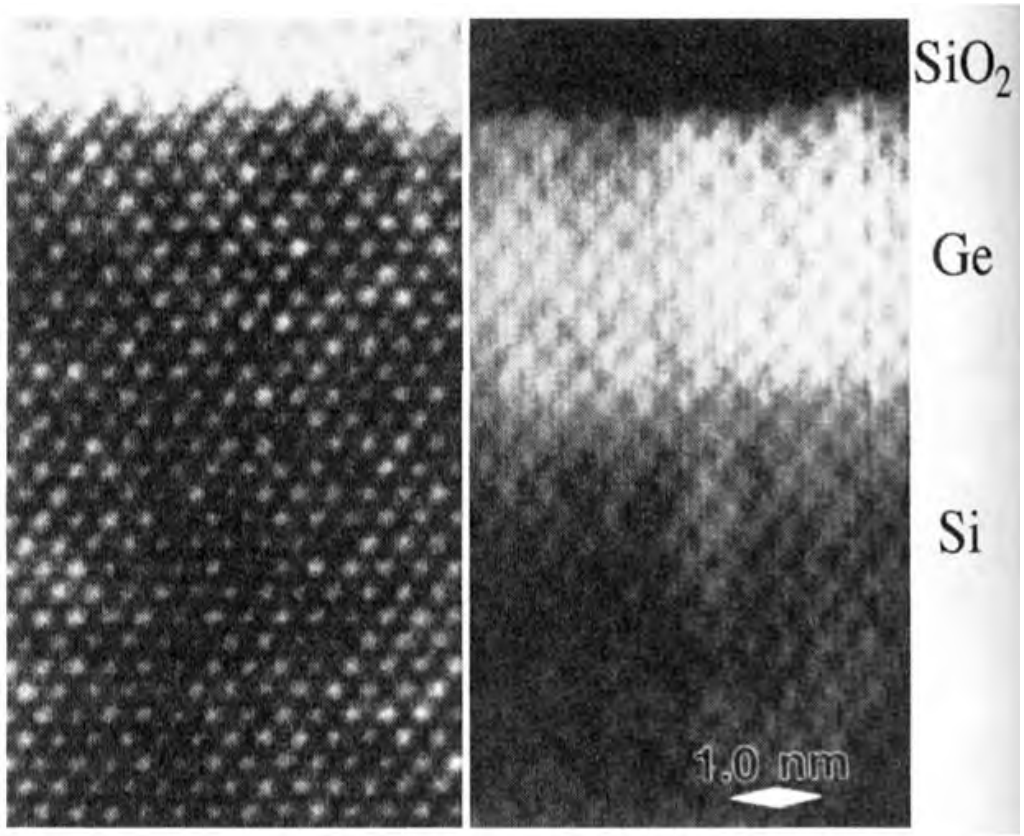
High Angle Annular Dark Field



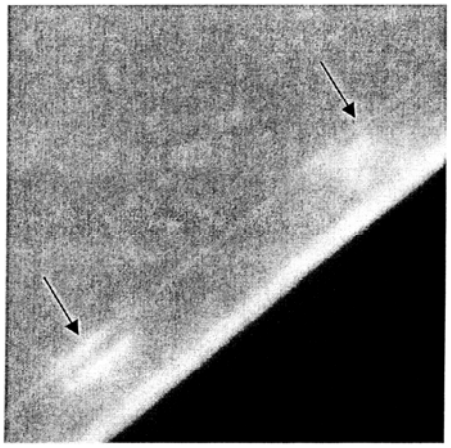
Collaborated with A. Lupini ORNL

SiO_2 on Ge on Si

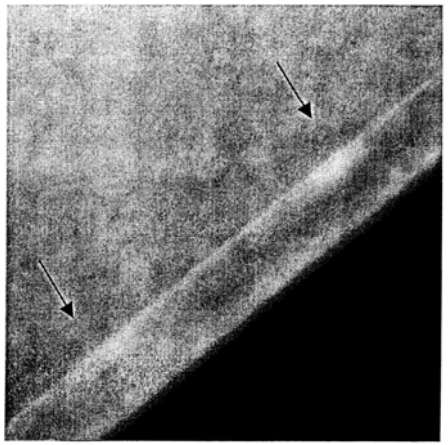
- Amorphous region is visible in hi-res
- Oxide is dark, Ge is light, Si in between - can see lattice



InGaAs quantum dots and well on GaAs



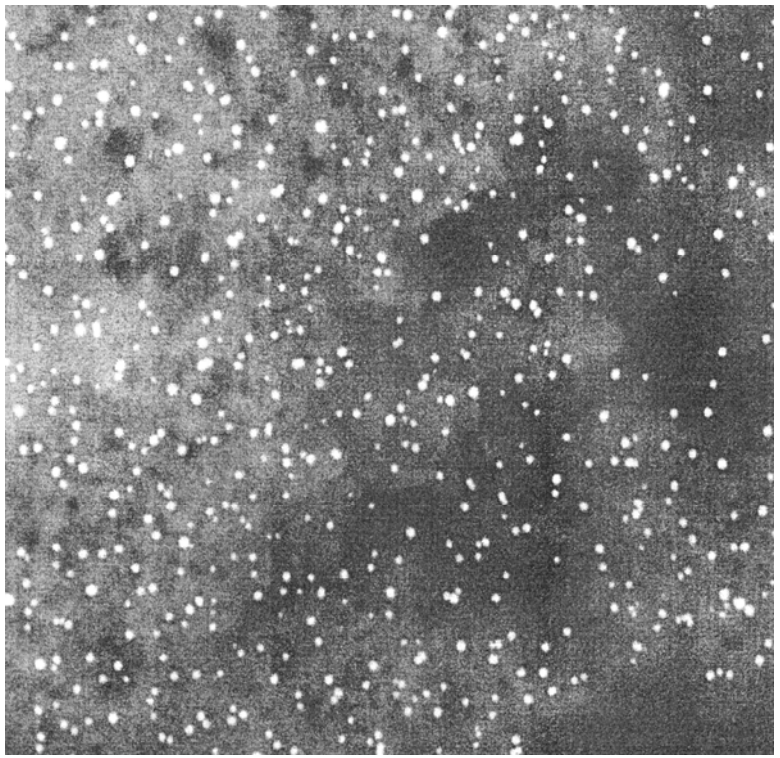
Low-angle annular dark field showing strain contast



High-angle annular dark field showing mostly Z contrast

P. Crozier,
ASU HREM Winter School 2003

Pt nanoparticles on carbon



P. Crozier, ASU HREM Winter School 2003

Bi-Implanted Si

- A shows low-res BF
  - Can't really see implant
  - Can see damage
- B is Z-contrast image
  - Bi lights up like Christmas
  - The damage layer is not so visible.
    - No phase contrast

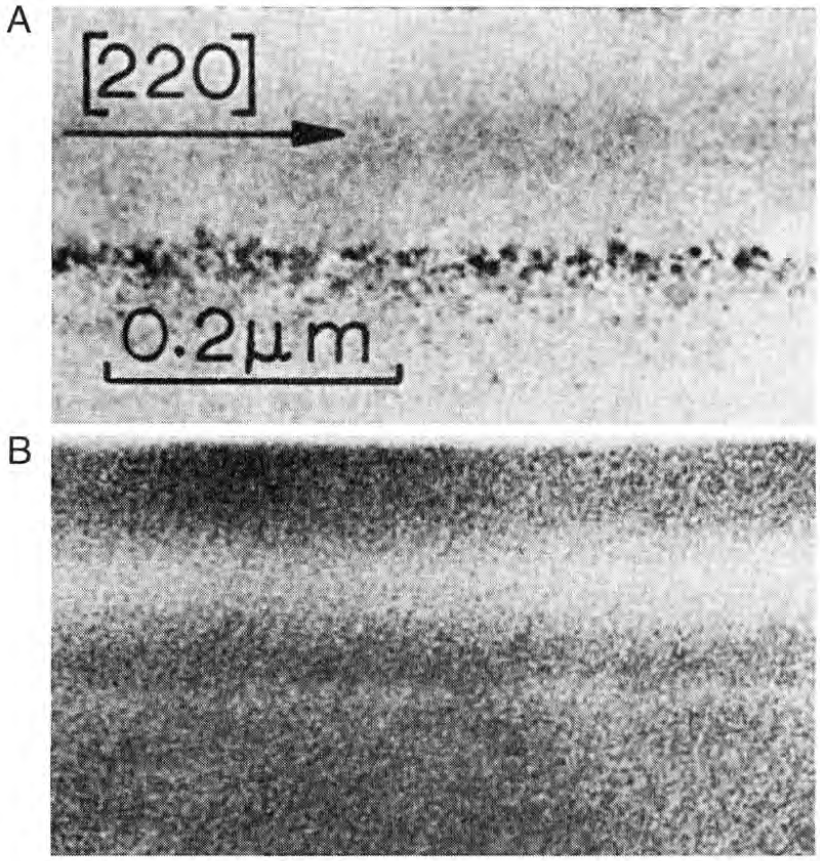
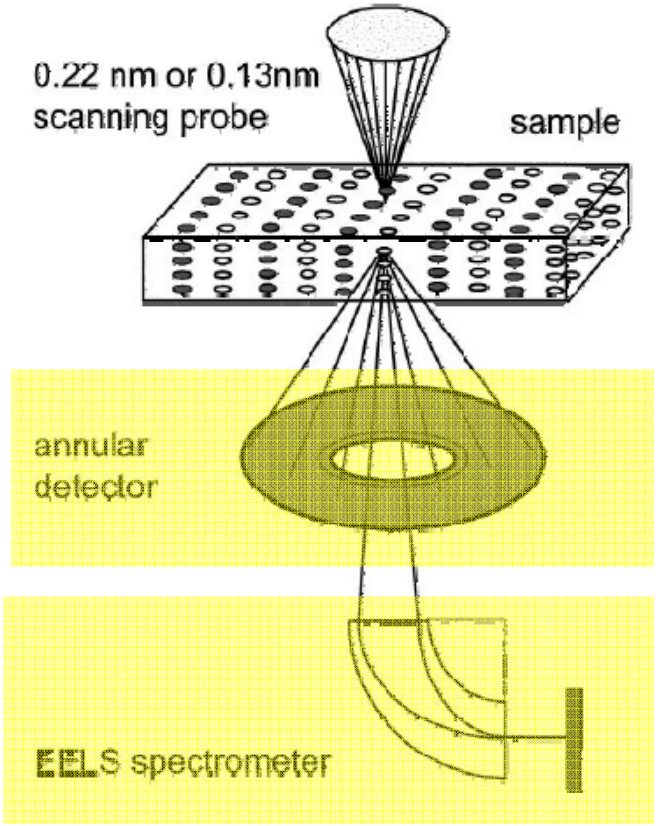


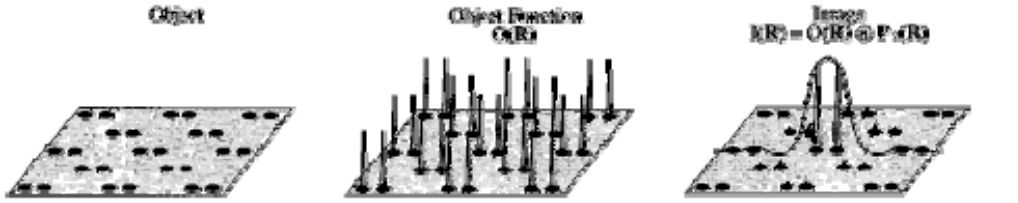
Figure 22.14. (A) Low-resolution TEM BF image showing a row of defects in Bi-implanted Si. In (B), obtained under Z-contrast conditions, the defects associated with the implant are invisible but the specimen is bright in the region implanted with Bi.

Examples borrowed from Williams & Carter

Structure model of GB in STO by z-contrast and EELS

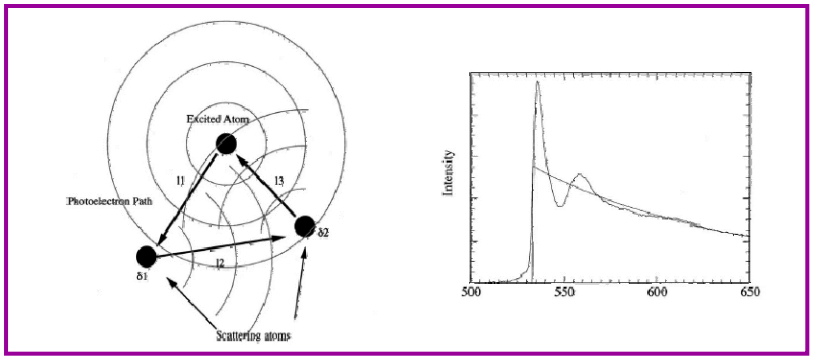


SETM



z-contrast imaging → heavier atoms → Sr (38) Ti-O ($22^{2+}8^{2}$)

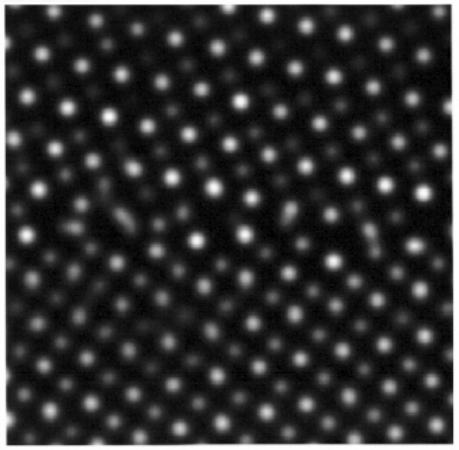
EELS → Bonding information Atomic configuration → O



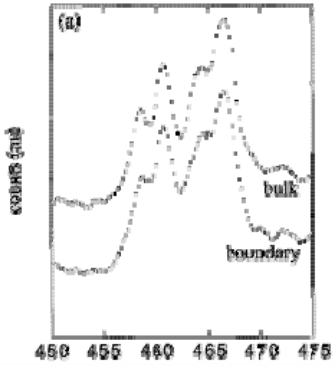
G.Duscher, J.P.Buban, N.D.Browning, M.F.Chisholm, S.J.Pennycook, *Interface science*, 2, 199 (2000)
N.D.Browning, H.O.Moltaji, J.P.Buban, Physical review B, 58, 8289 (1998)

STEM: VG HB501 UX

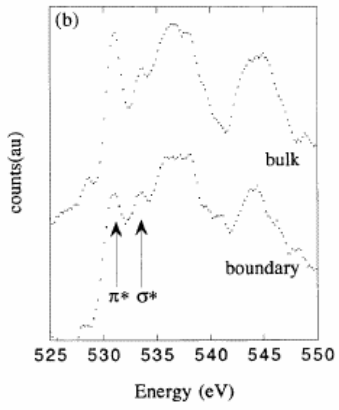
Voltage: 100kV



25° (920)[001]
Grain boundary



No big change → Ti atoms remain octahedrally coordiniated to O atoms → Ti is still 4+

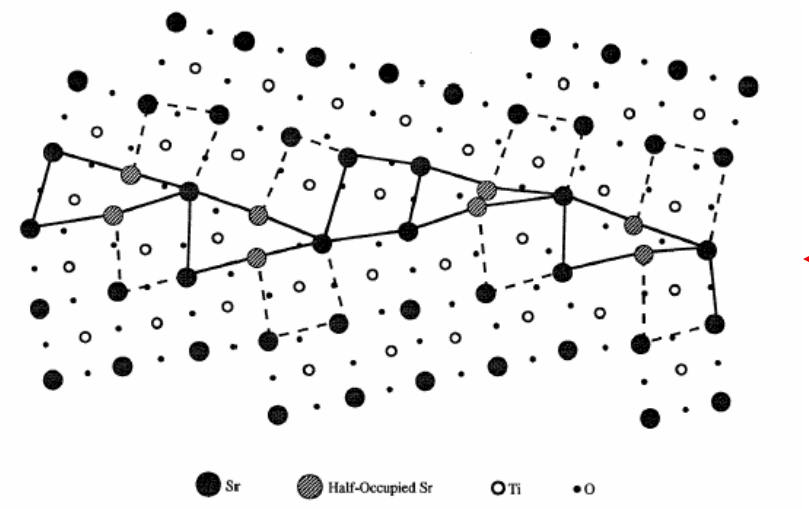


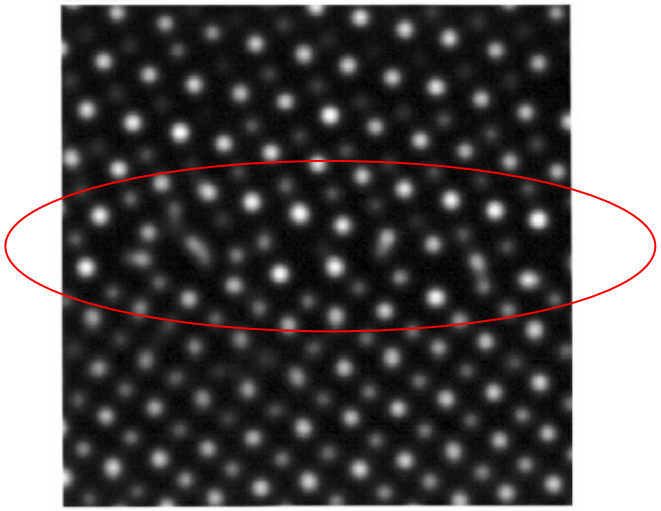
Broadening of π * and σ * peaks

Increase of σ * relative to π *

→ distortion of O-Ti-O bonds

M.M.McGibbon, N.D.Browning, M.F.Chisholm, A.J. McGibbon, S.J.Pennycook, V.P.Dravid, *Science*, 266, 102(1994)





Valence	Calculated based on bulk matter	Structure unit in GB
Sr	2.11	2.11 ± 0.23
Ti	4.14	4.08 ± 0.24
O	2.08	2.08 ± 0.29

M.M.McGibbon, N.D.Browning, M.F.Chisholm, A.J. McGibbon, S.J.Pennycook, V.P.Dravid, *Science*, 266, 102(1994)