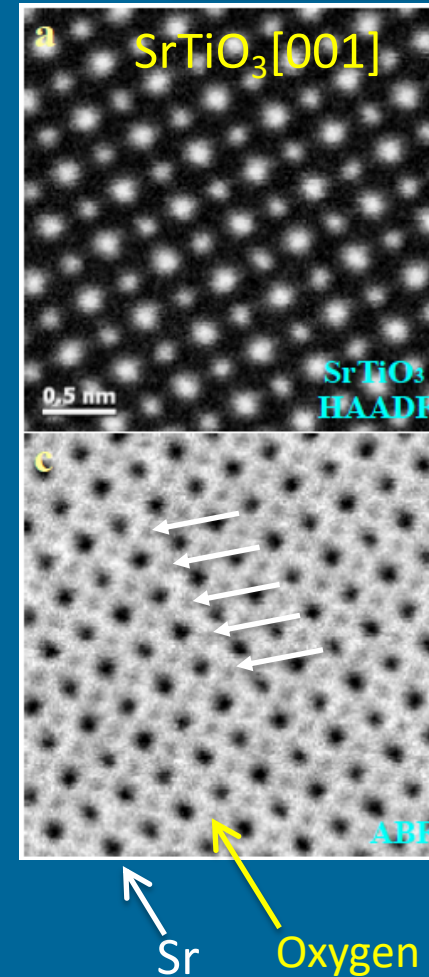
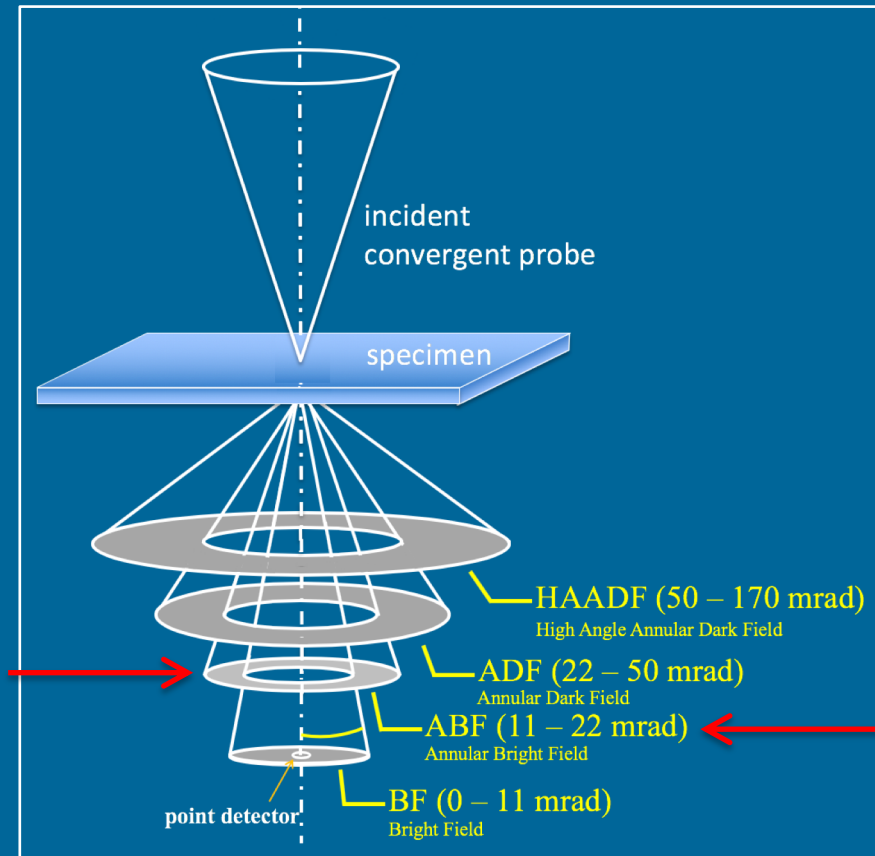


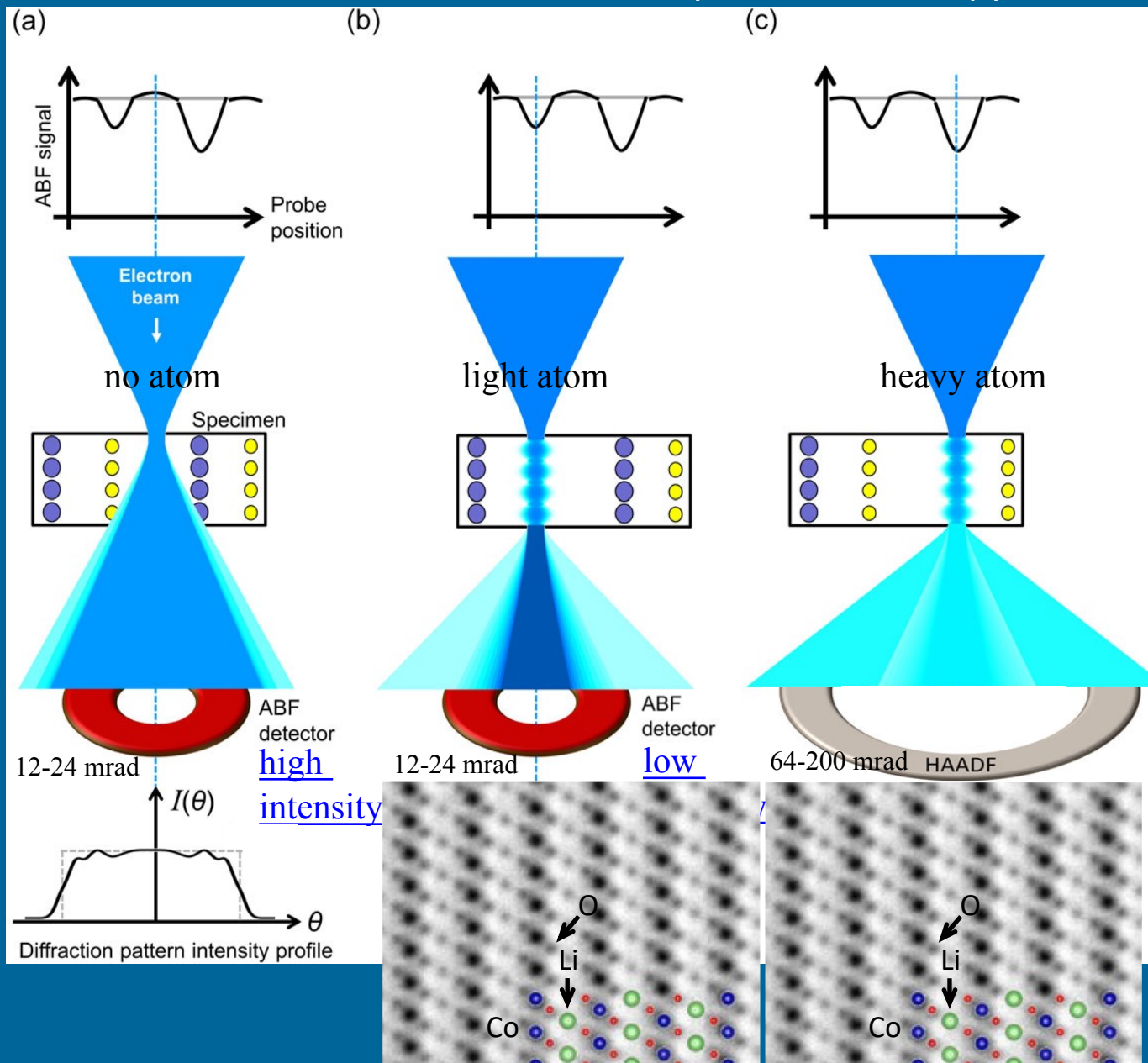
Annular Bright Field (ABF)

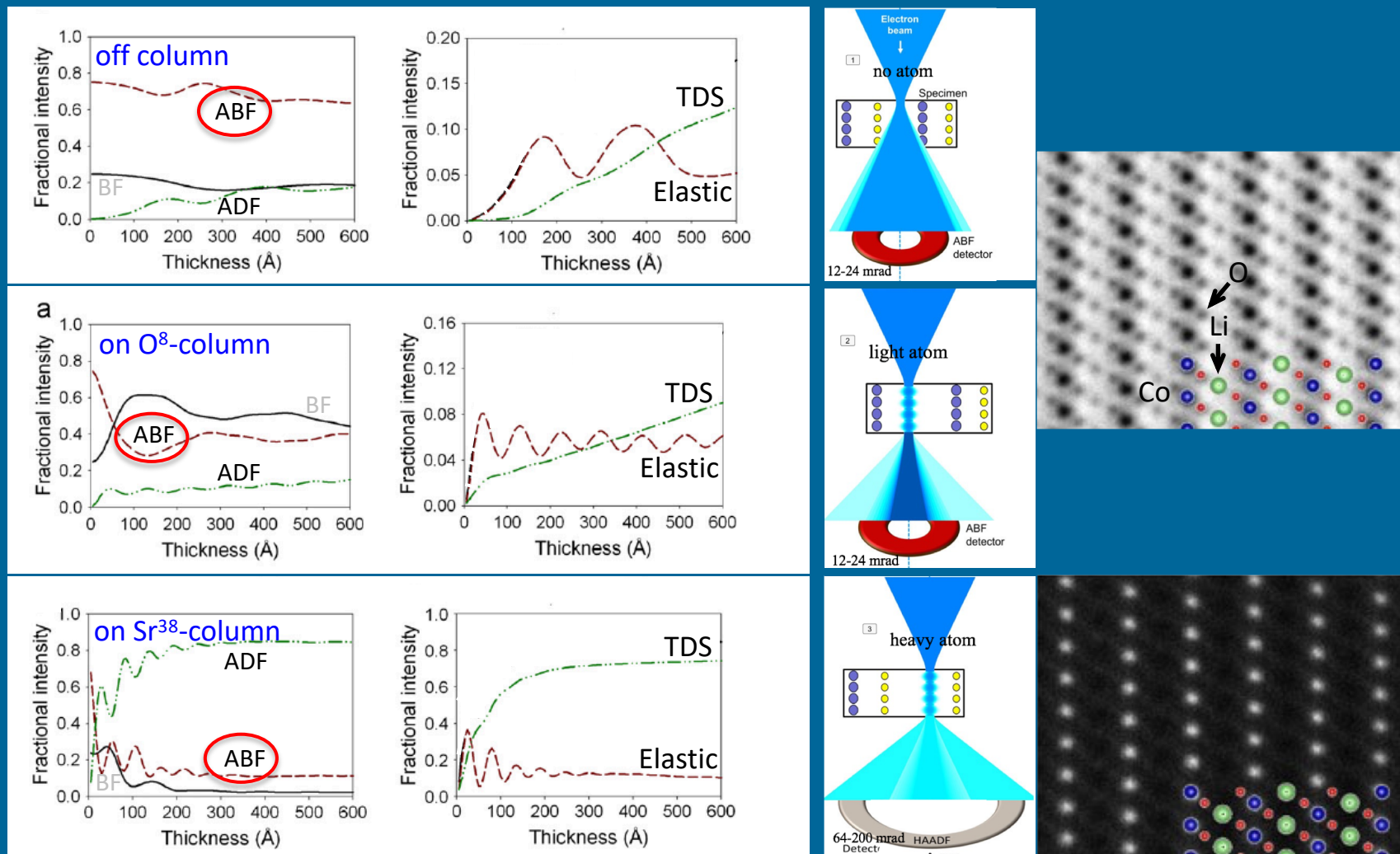
Okunishi et al., M&M 15 (Suppl.) 164 (2009)
ABF for 200 keV: 11 to 22 mrad



Annular Bright Field (ABF)

S.D. Findlay et al., Microscopy 2017, 3.





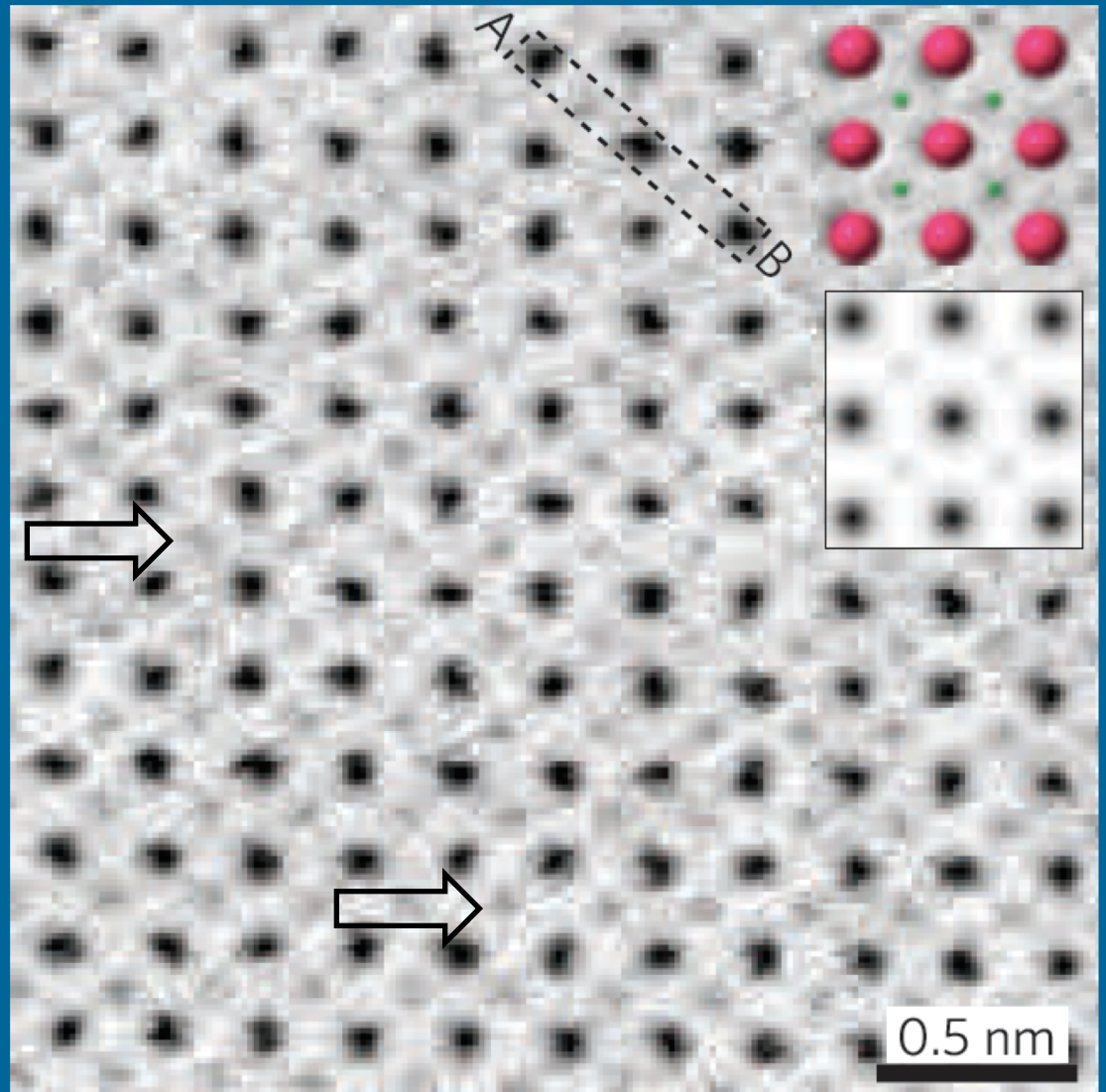
200 keV

BF: 0-11 mrad

ABF: 11-22 mrad

ADF: 22-400 mrad

Imaging
of hydrogen by STEM ABF
in YH_2



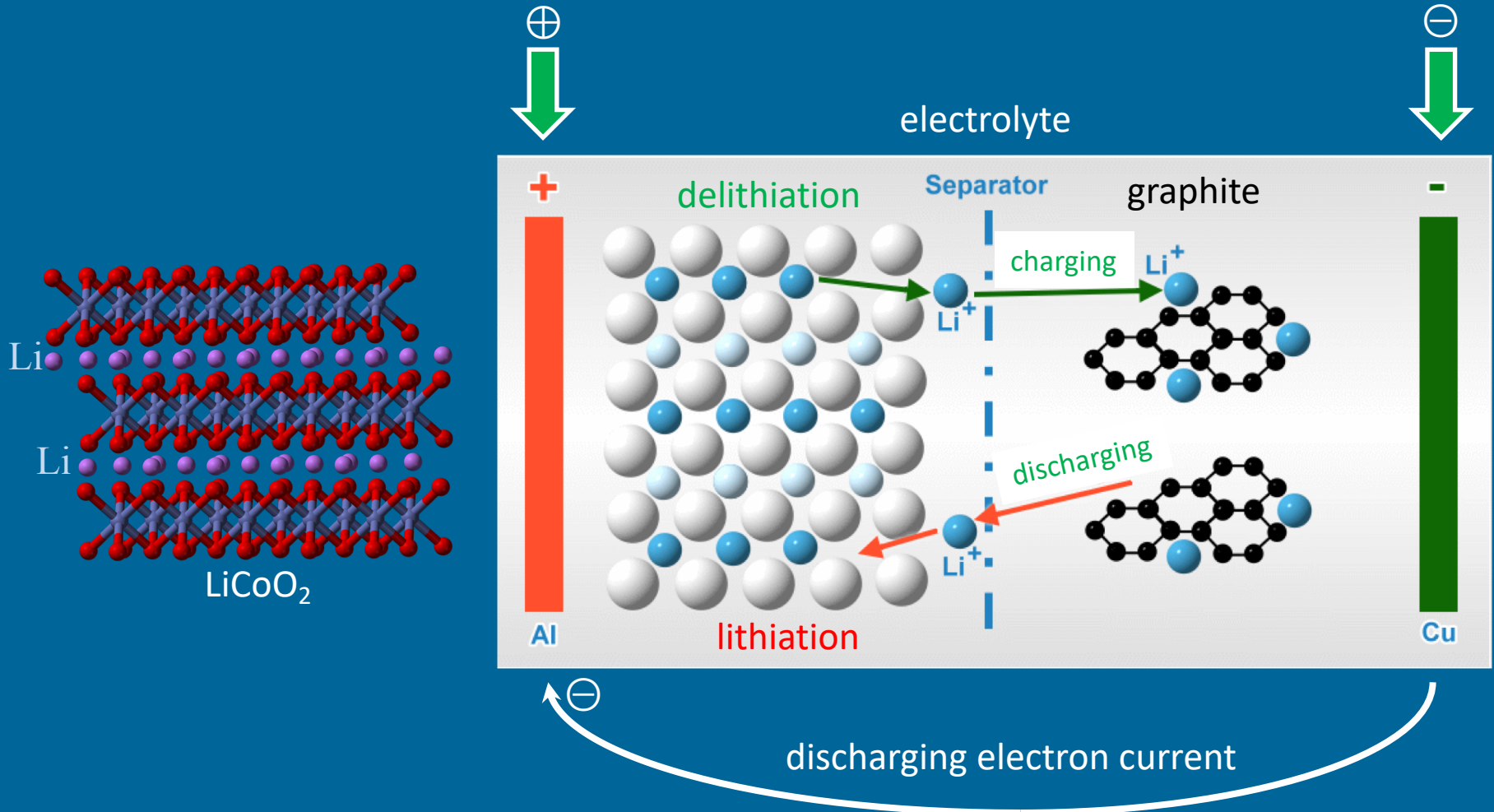
Ryo Ishikawa, Eiji Abe et al. Nature Mat. 10, 278 (2011)

Annular Bright Field (ABF) STEM

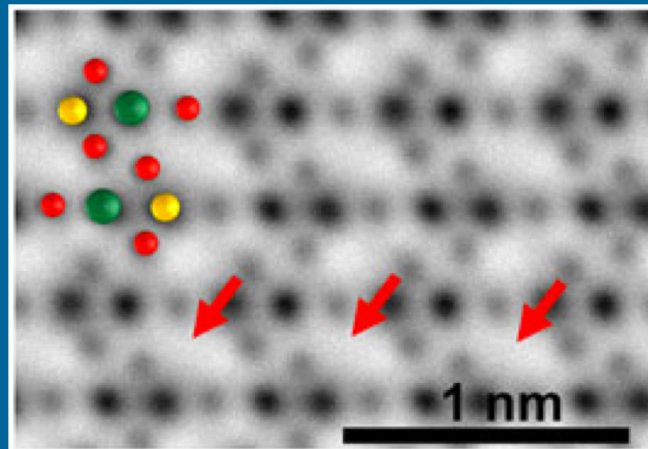
Last Example

Processes in Li-ion batteries

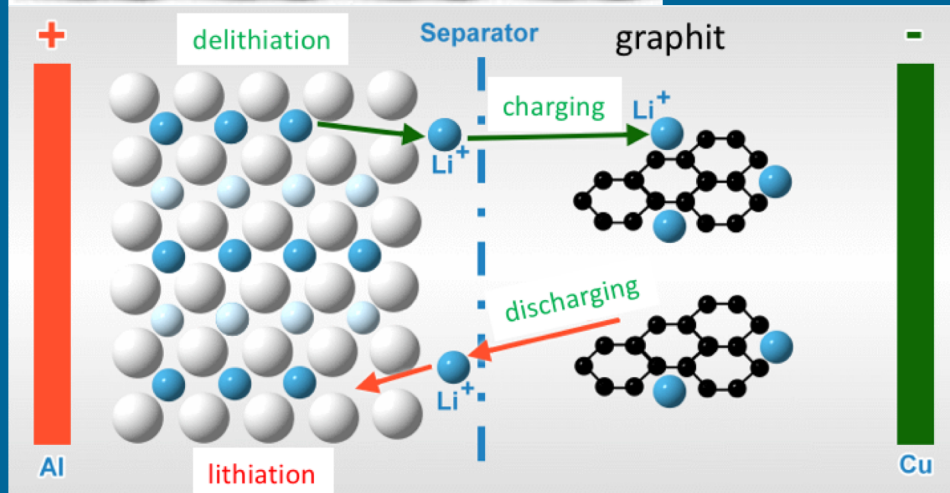
Lithium ion battery



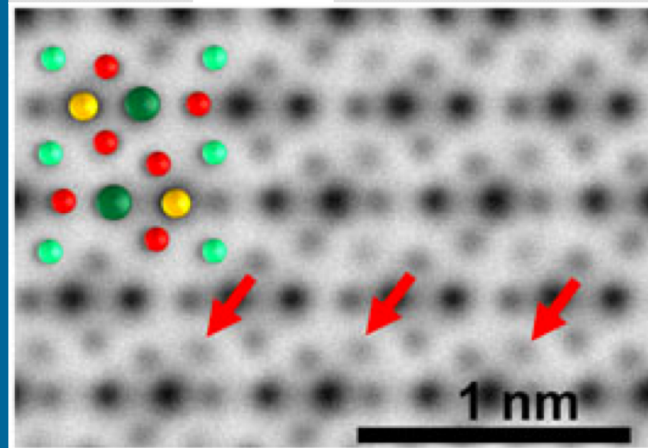
de-lithiated



(Li)FePO₄



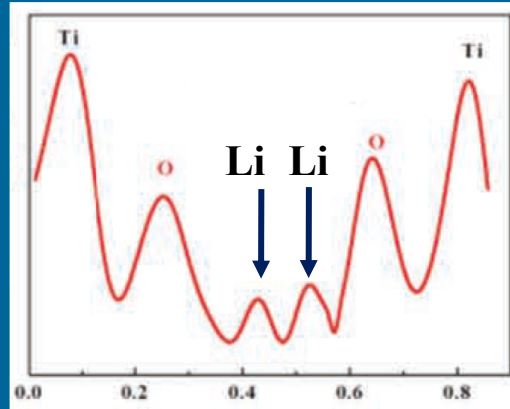
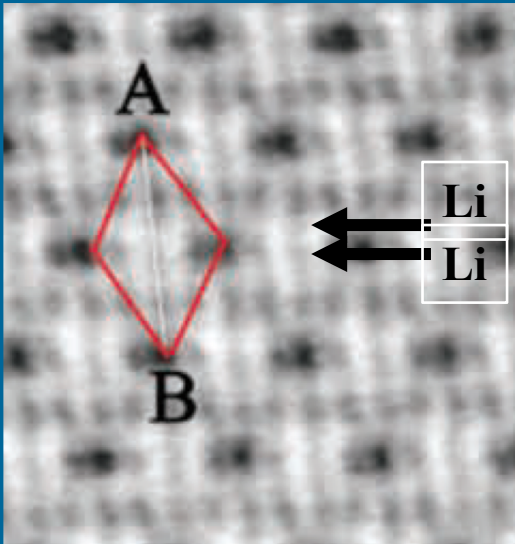
lithiated



JARA

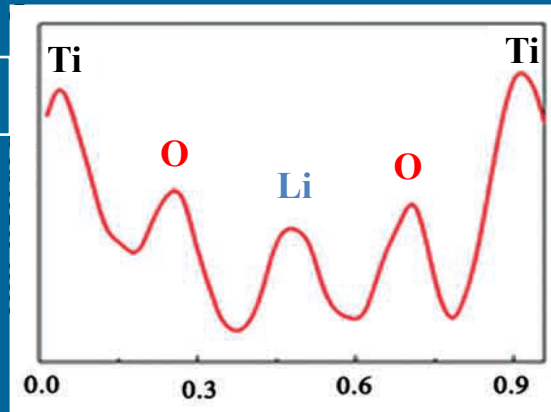
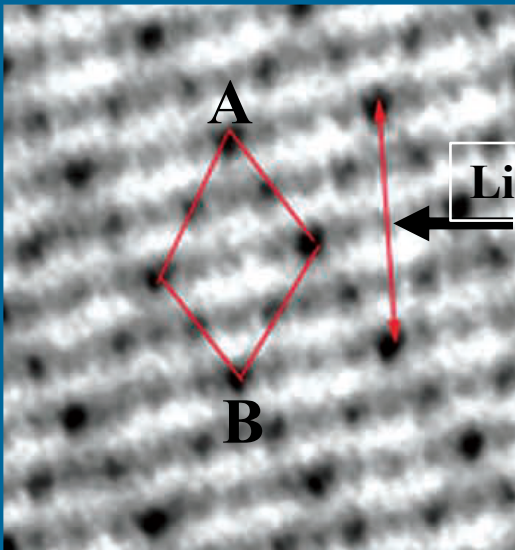
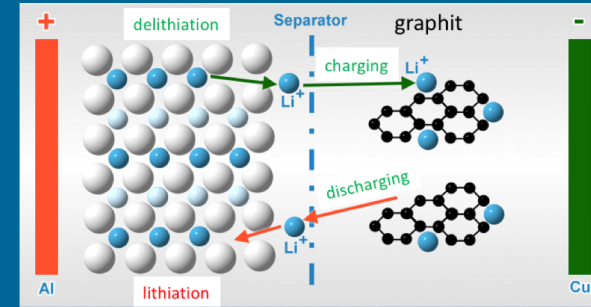
ER-C

de-lithiated



$\text{Li}_4\text{Ti}_5\text{O}_{12}$ phase

$\text{Li}_4\text{Ti}_5\text{O}_{12}$ spinel

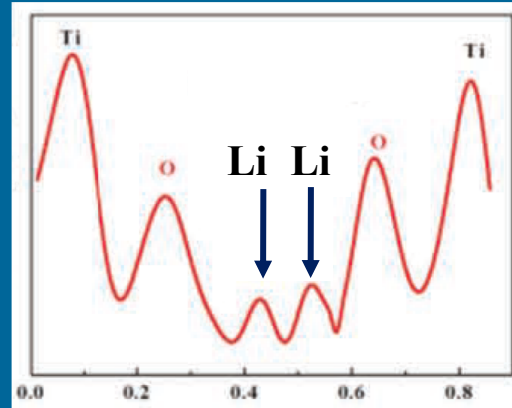
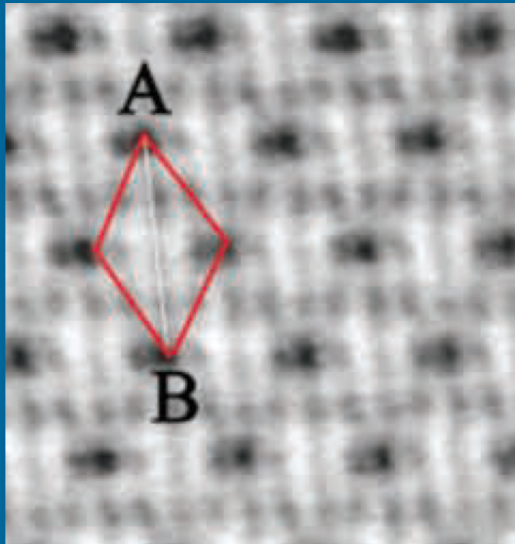


$\text{Li}_7\text{Ti}_5\text{O}_{12}$ phase

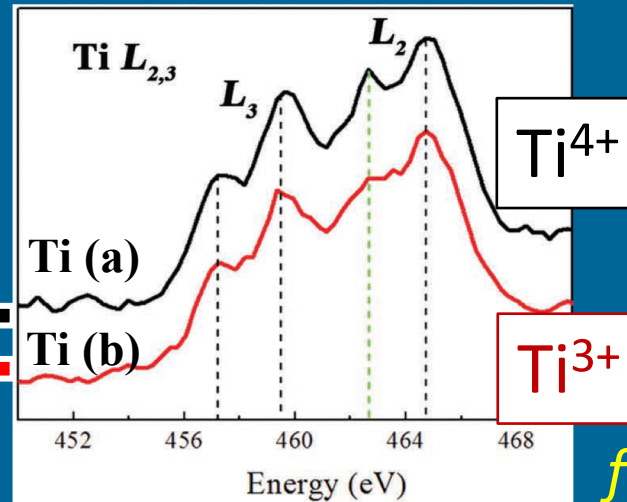
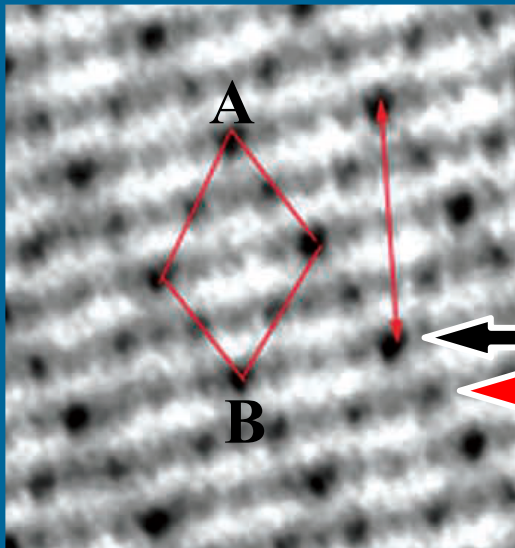
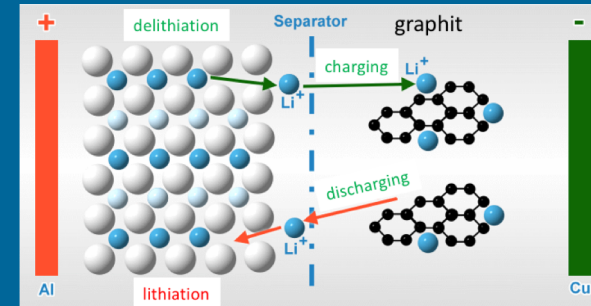
JARA lithiated

ER-C

de-lithiated



$\text{Li}_4\text{Ti}_5\text{O}_{12}$ spinel



EELS

fingerprint

$\text{Ti}^{3.4+}$

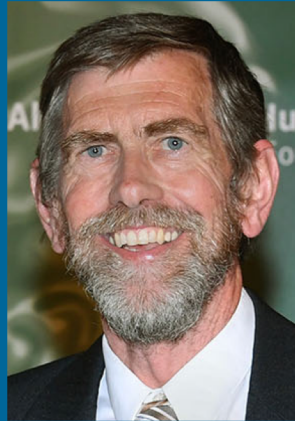
JARA lithiated

$\text{Li}_7\text{Ti}_5\text{O}_{12}$ phase

ER-C

The END
of Lecture 2: STEM

Acknowledgement



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Lei Jin