

M3D5: Battery assembly and testing

12/06/2016

1. LAST Quiz
2. Prelab Discussion
3. Battery assembly demo: Belcher lab
4. Refine Research Proposal and draft figures for mini-report

The final countdown...

- Lab notebook entry
 - M3D3 graded by Emily at 10pm tonight
- No lecture Thursday
- M3 research proposal **THURS**
 - slides due on Stellar ~~Friday~~, December 8th at 1pm
 - bring **one print-out of your slides** to 16-336
- M3 mini-report
 - due on Stellar at 10pm Monday, December 12th
 - (background + overall approach), TEM images, elemental map (spectrum), charge/discharge plot, capacity value, class-wide data analysis
- Blog posts **:2 left - Mod 3 + Overall**
 - due Wednesday, December 14th

Module 3 overview: biomaterials engineering

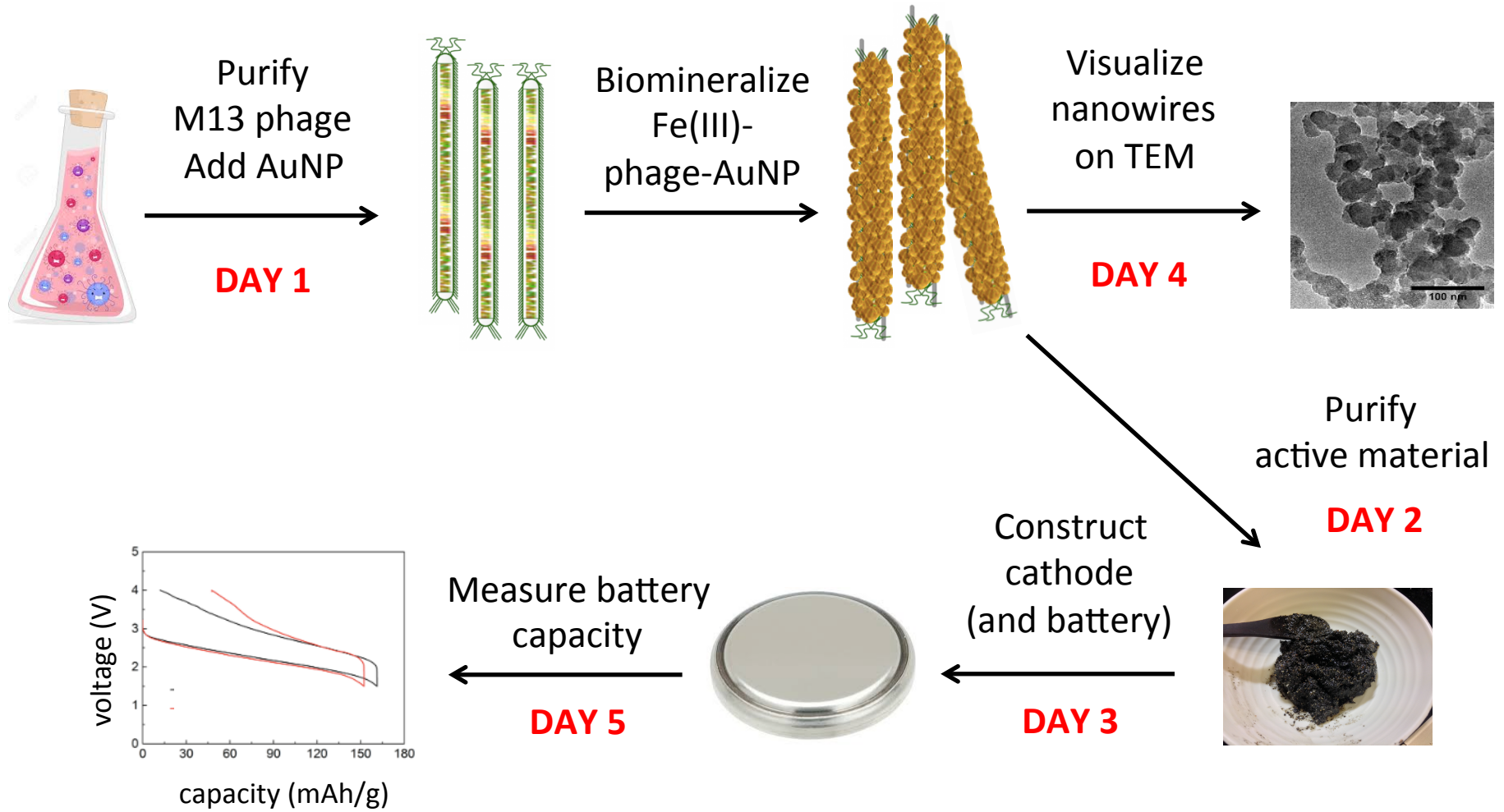
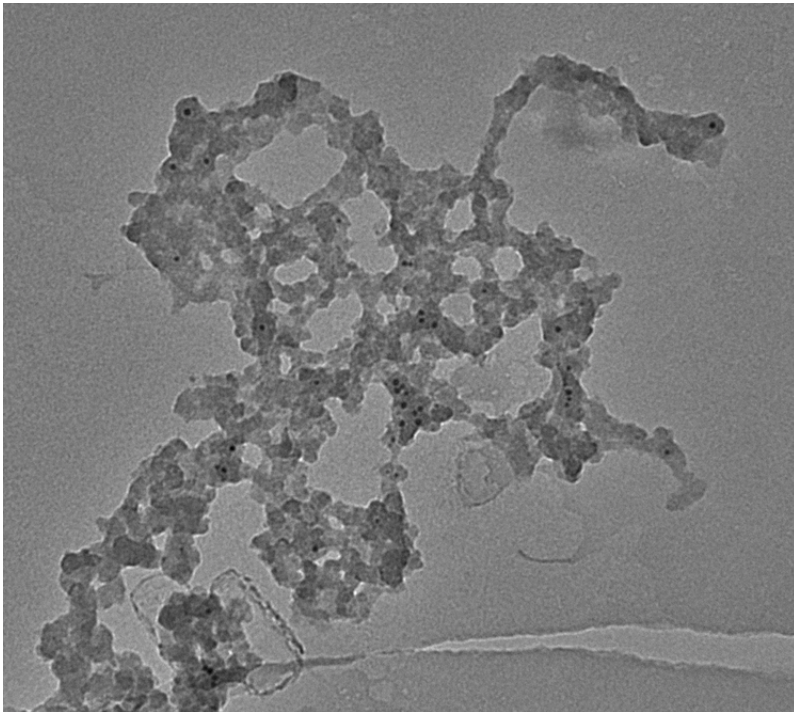


Figure: TEM images

- at low magnification:

- extent of biomineralization
- distribution of gold
- overall structure & density
- uniformity
- length of nanowires



- at high magnification:

- size of gold nanoparticles
- lattice of gold atoms (*i.e.* 111)
- amorphous vs. crystal Fe(III)PO_4
- diameter of nanowires

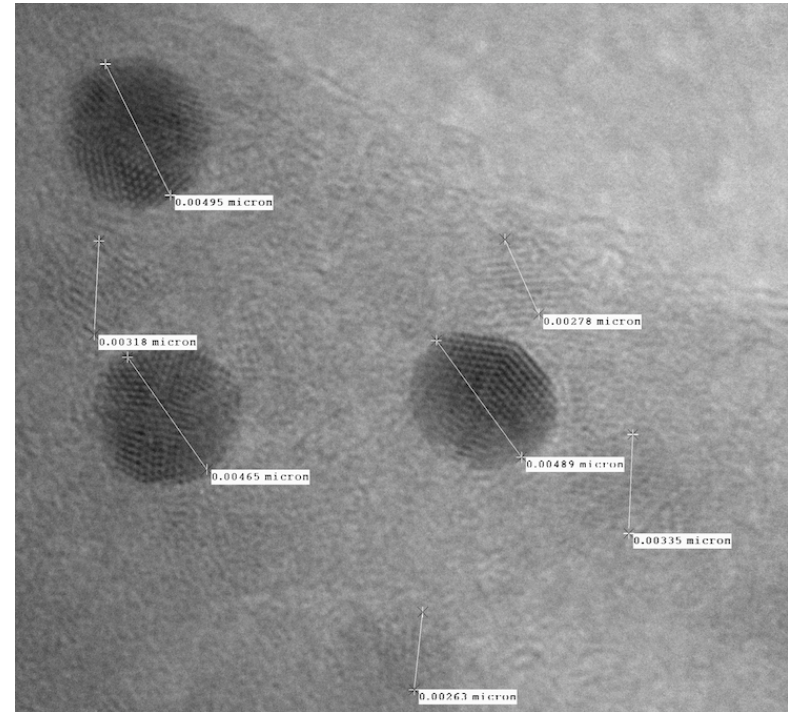
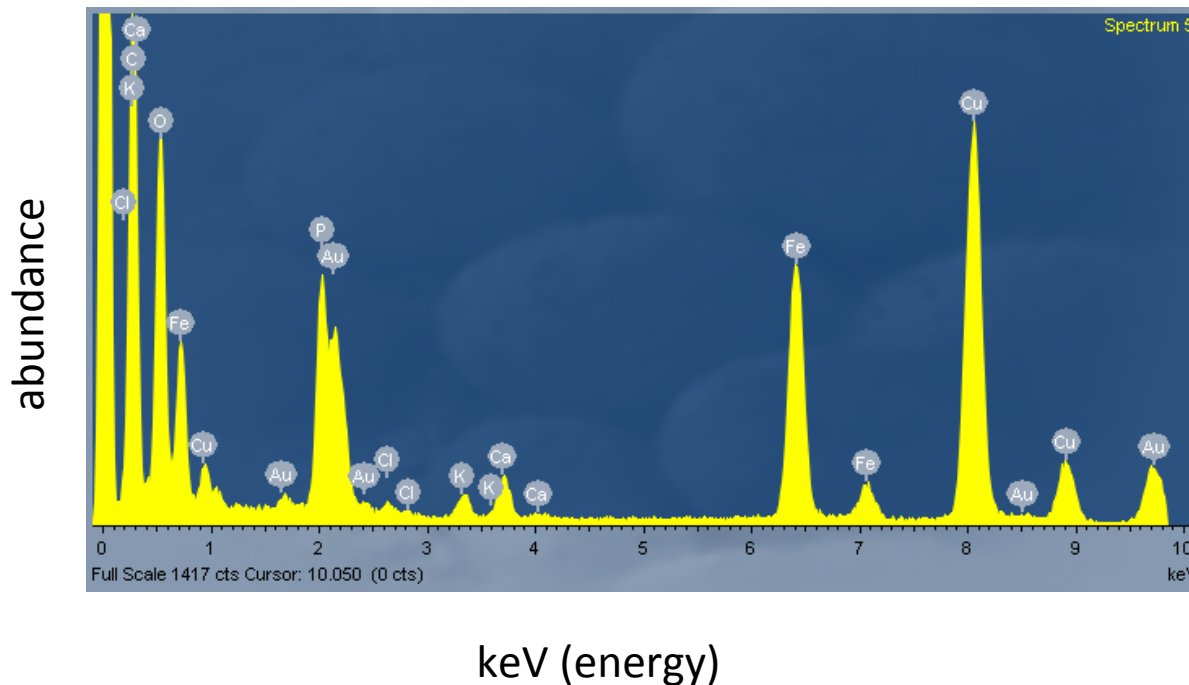


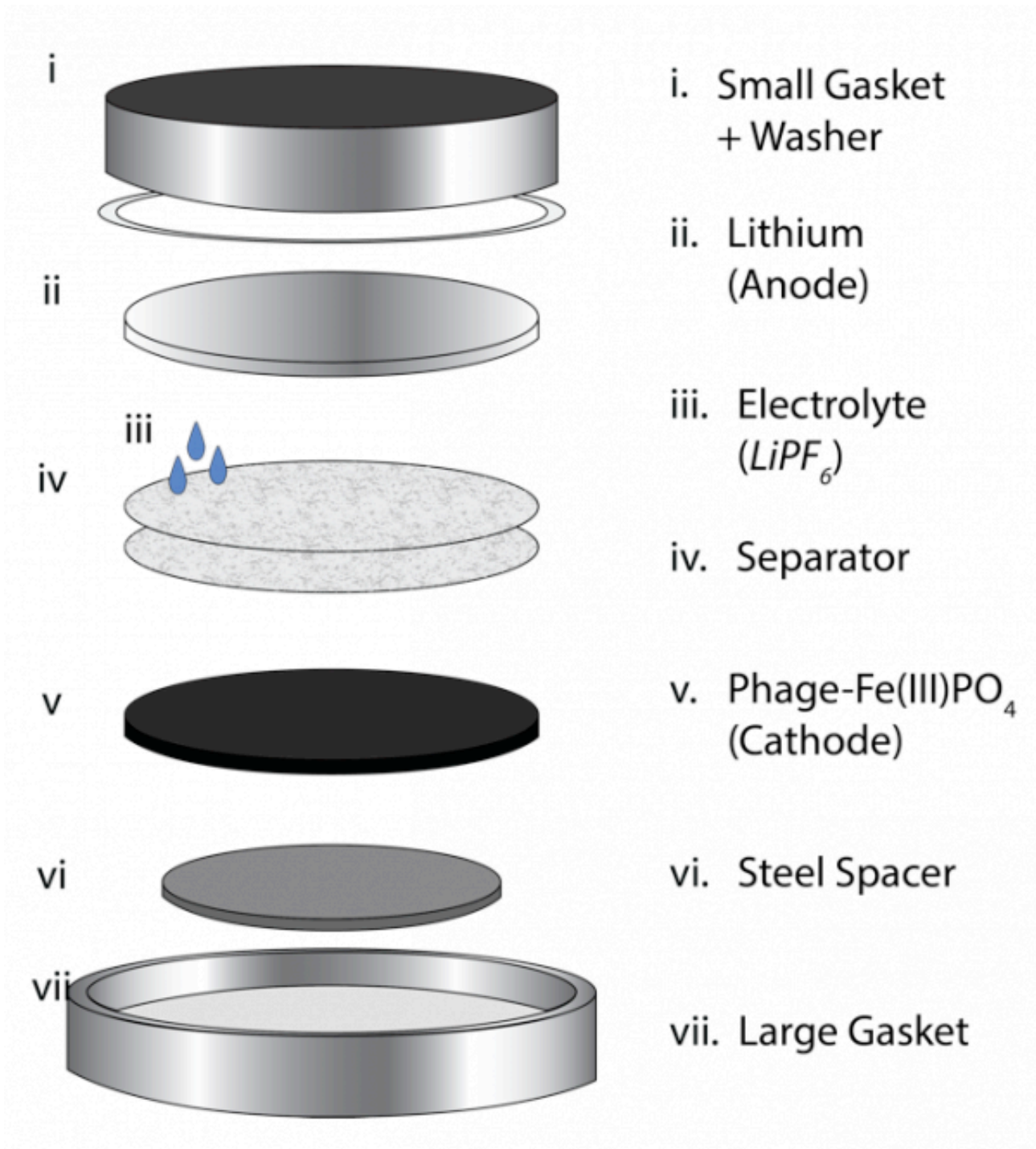
Figure: EDX elemental mapping

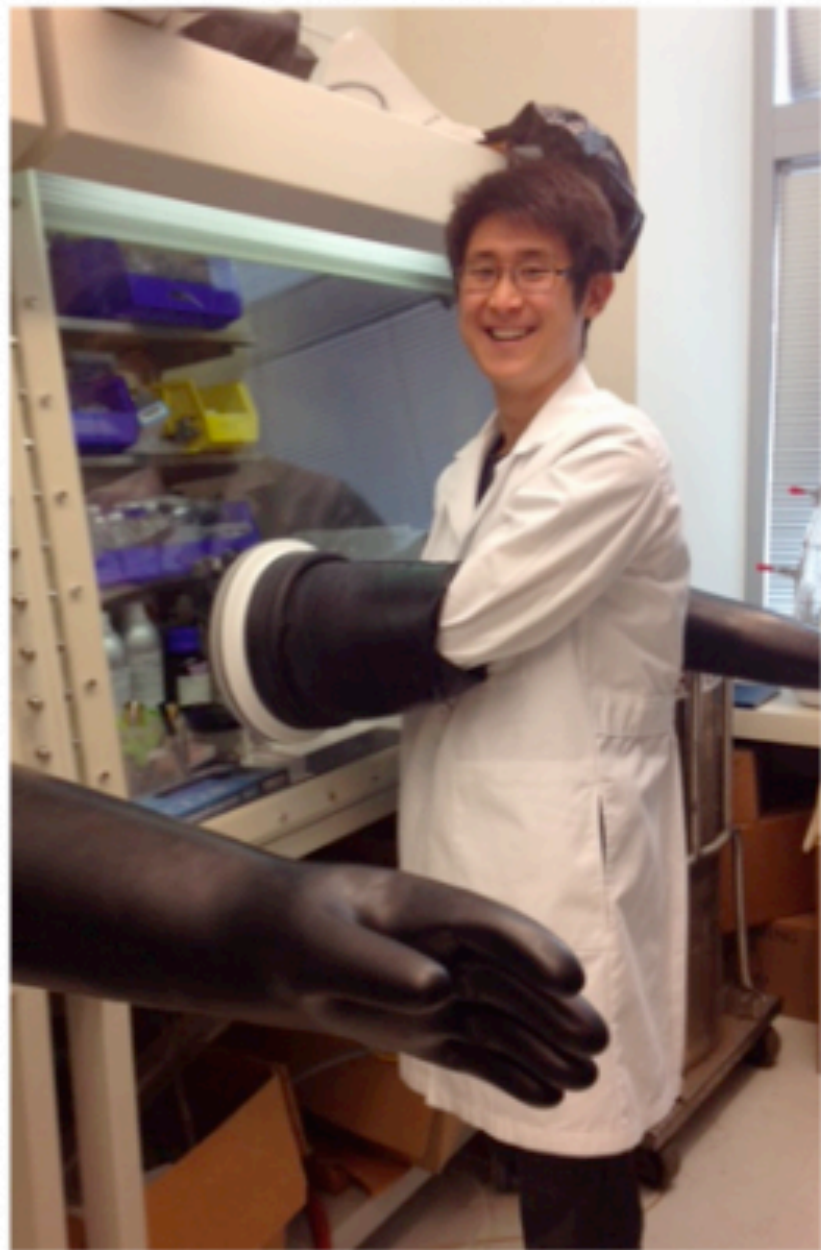
- expected: Fe, P, O, Au, (Cu)
 - contamination? Na, Cl, K, Ca (from diH₂O)
 - Si **silicon**
 - stoichiometric ratios?

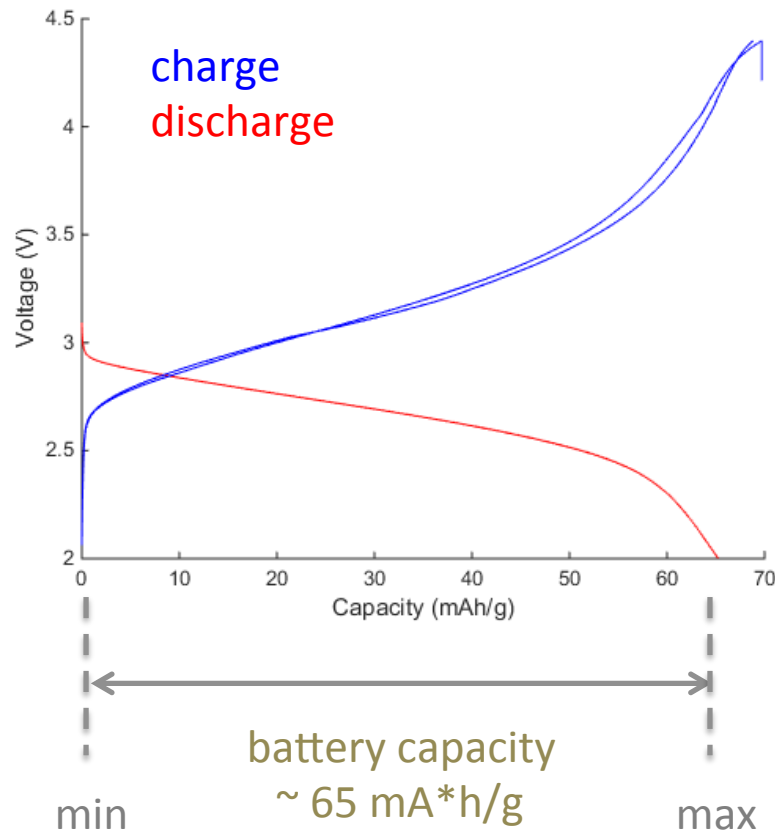


Element	Atomic%
C K	55.01
O K	22.88
P K	5.04
<u>Cl</u> K	0.24
<u>K</u> K	0.46
Ca K	0.77
Fe K	5.46
Cu K	9.34
Au L	0.79
Totals	

Today: Battery assembly







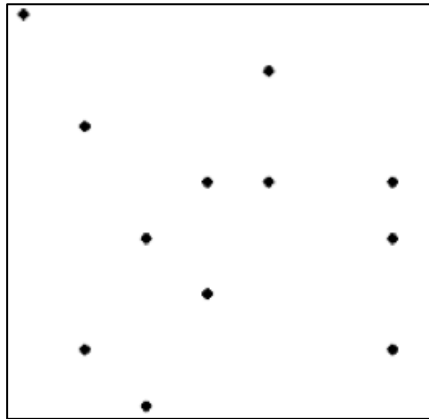
Result / figure: Battery capacity

- Theoretical capacity of Li – LiFe(II)PO₄ battery: 178 mA*h/g
- Practically
 - analyze cycling data
 - summary by Jifa

- Galvanostat:

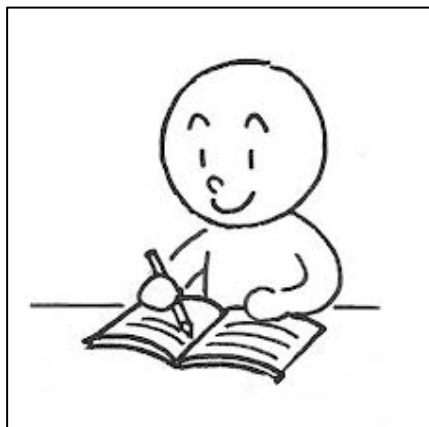
- keep current constant (- 89 mA/g for 2h discharge)
- record voltage (ideally constant)
- as charge (capacity) stored in battery fluctuates (drops during discharge)

Does gold size affect battery capacity?



- Use class-wide data
 - we will post data from Jifa for all capacities
 - M3 main Discussion page for AuNP size & quantity

Today in lab:



- Demo in Belcher Lab:
 - 1st group: green and blue
 - 2nd group: yellow, pink and purple
- Refine your M3 research proposal