M3D2:Purify active material

04/24/2018

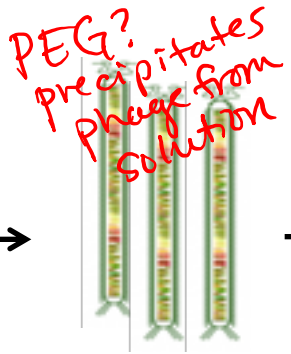
1. BE Communication lab workshop: Research Proposals!
2. Prelab discussion
3. Collect and wash active material: AuNP-Fe(III)-phage nanowires
4. Demo of $FePO_4$-phage reaction
5. Prepare TEM samples
6. Prepare active material for 80°C vacuum oven

Module 3: biomaterials engineering

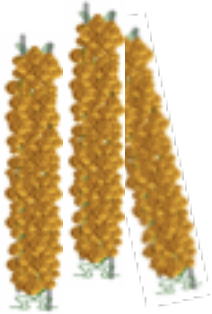
How do nanoparticle size and quantity affect battery capacity?

Purify
M13 phage
Add AuNP

DAY 1

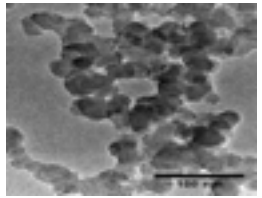


Biomineralize
Fe(III)-
phage-AuNP



Visualize
nanowires
on TEM

DAY 4



Purify
active material?

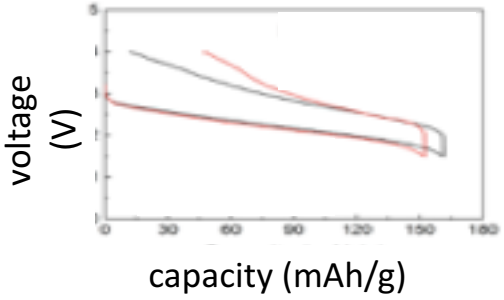
DAY 2

Construct
cathode
(and battery)

DAY 3

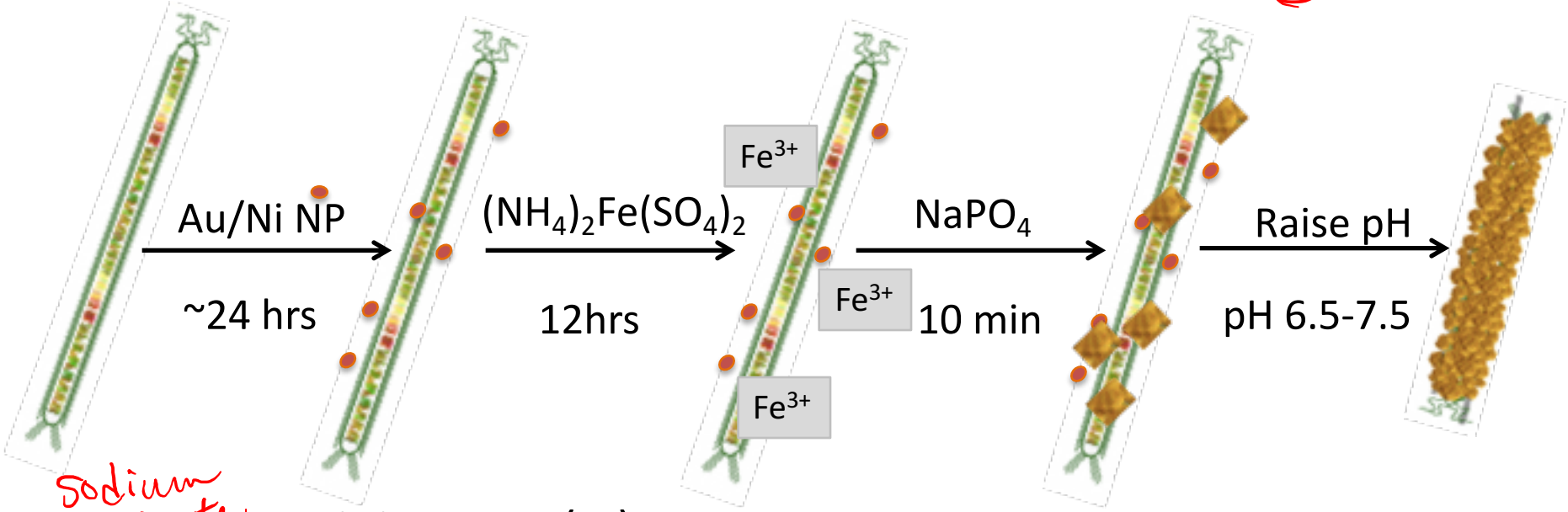
Measure battery
capacity

DAY 5



Phage Biomineralized with Iron and NPs

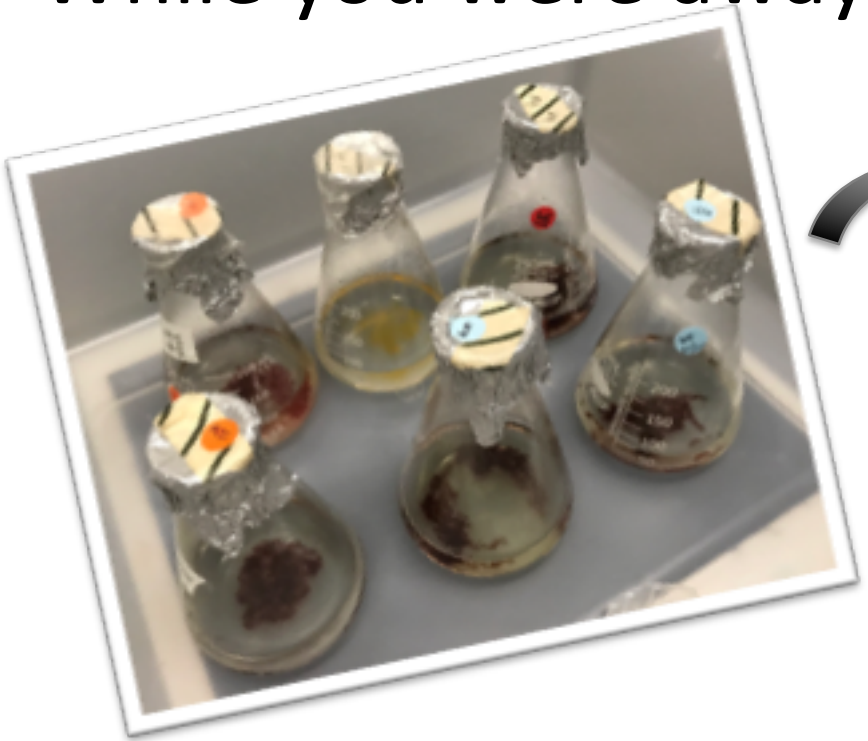
P8 coat protein modified to include DSPHTELP (+ / –) peptide)



sodium phosphate precipitates Fe(III)

amorphous iron facilitates ion insertion into cathode material

While you were away…



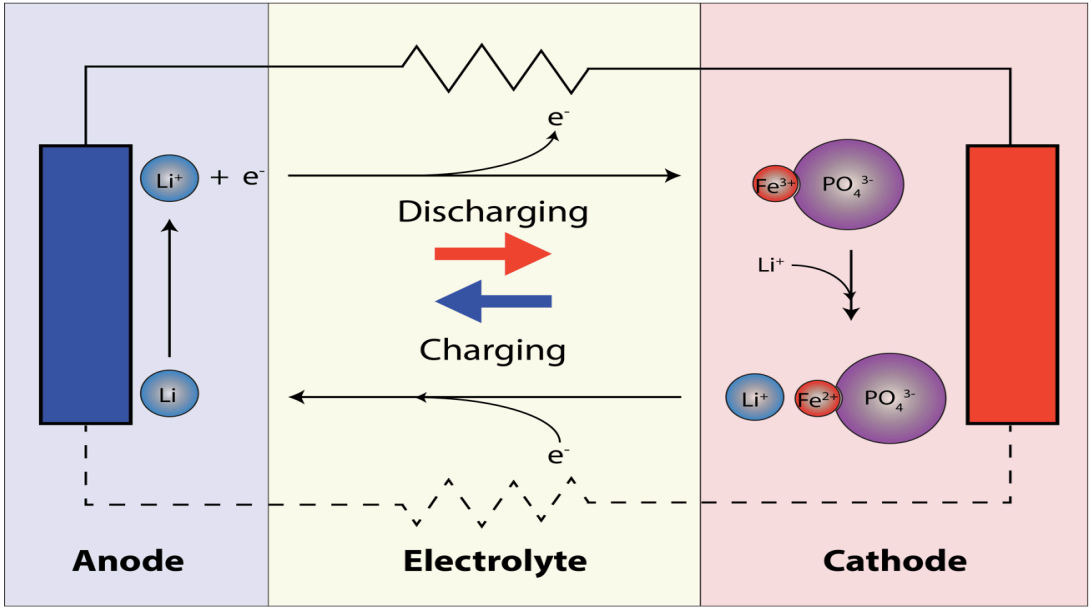
Last night added: $(NH_4)_2Fe(SO_4)_2$
This morning added: $NaPO_4$
& pH to 6.5

Diagram of Mod3 battery

M13 phage: Scaffold

AuNP (& SuperP): electrical Conductor

Fe(III) PO4: ionic Conductor

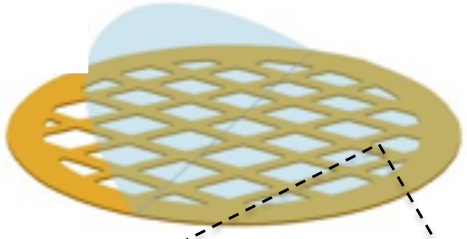


Set aside Fe(III)-phage-NP for TEM inspection

- The Fe(III)-phage-NP active material is in its purest form
  - No impurities, binder, etc.

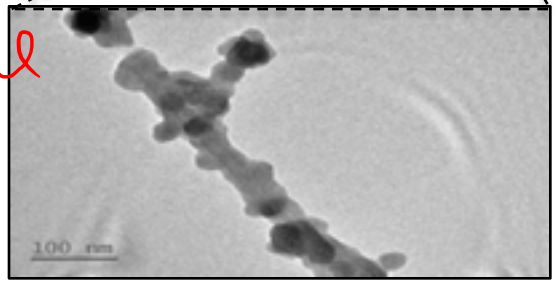
- Cu-grid, carbon mesh
  - Copper-orange side
  - ✓ Silver/black side where droplet deposited

  ➢ Practice handling it with tweezers



side view

sample
Carbon mesh
Cu-grid



In lab today…

1. Do Part 3 First (Collect active material)
2. Demo of $FePO_4$-phage reaction during spin
3. Practice then prepare TEM samples
4. Prepare active material for 80°C vacuum oven

- During the downtime you should discuss and choose a topic for M3D3 homework (and potentially beyond!) submitted as a pair/team
- Class time Tues. 5/1 Prof. Belcher would like to hear elevator pitches from all groups.
- Reminder: Quiz on Thursday

No LAB Tuesday