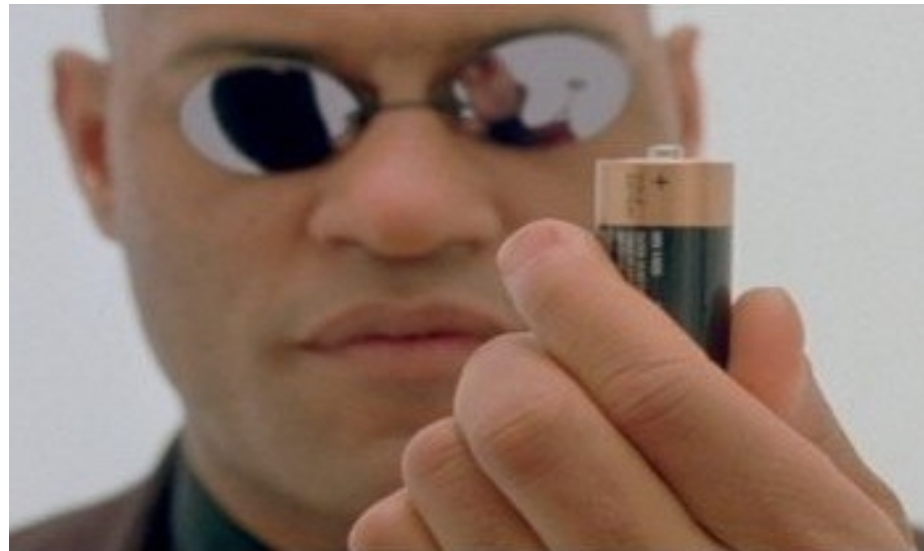


M3D3: Cathode construction

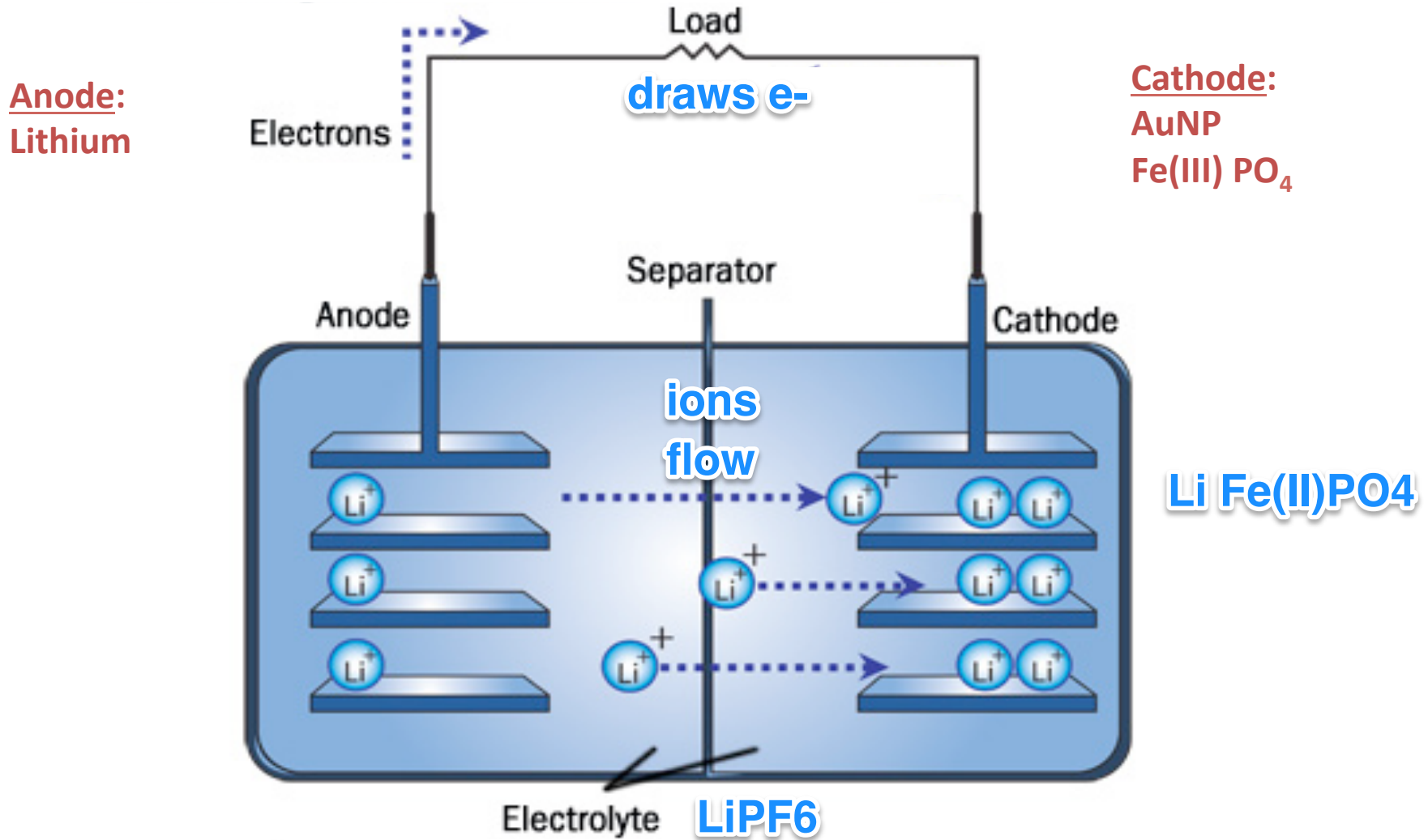
4/28/2016

1. Prelab Discussion
2. Construct cathode material (Belcher Lab)
3. Research Proposal Peer Review Exercise
(20.109 lab)



- ***M3 major assignments***
 - Research proposal (20%), slides due 5/12 at 1pm
 - Mini-report (5%), due 5/16 at 10pm
- **M3D4 Homework, [Both parts submitted as a team](#)**
 - Research Proposal Presentation outline (wiki, google doc, benchling)
 - ***address topics in HW prompt for full credit***
 - Outline Background and Approach for mini-report ***with references***
 - <http://belcherlab.mit.edu/publications/>

Is this battery **discharging** or charging?

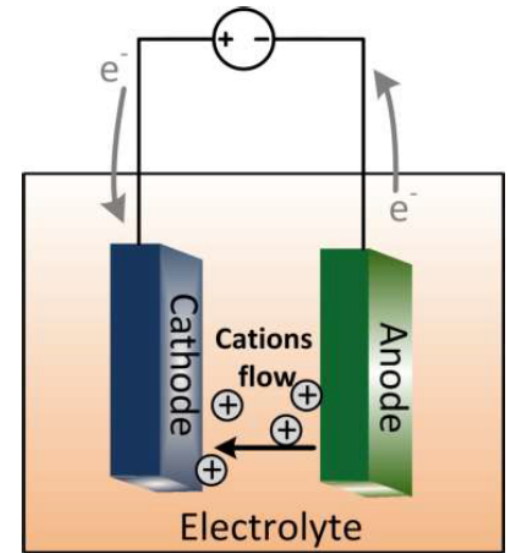


©2006 HowStuffWorks

charging, e- and ions flow in opposite direction

Main components of a battery

- During **discharge**,
 - cathode accepts electrons e^- and lithium ions Li^+ **donate e^-**
- Battery consists of two electrodes:
 - cathode = positive electrode, **accept** electrons
 - anode = negative electrode, **gives** electrons
 - In rechargeable battery, when is electrode polarity defined? **discharge**
 - **electrolyte** allows for flow of ions
- What is **capacity**?
 - quantity of electricity (charge) involved for the electro-chemical reaction between the active materials in the battery
 - for our Fe(III)-phage batteries, the theoretical capacity is 178 mA*h/g

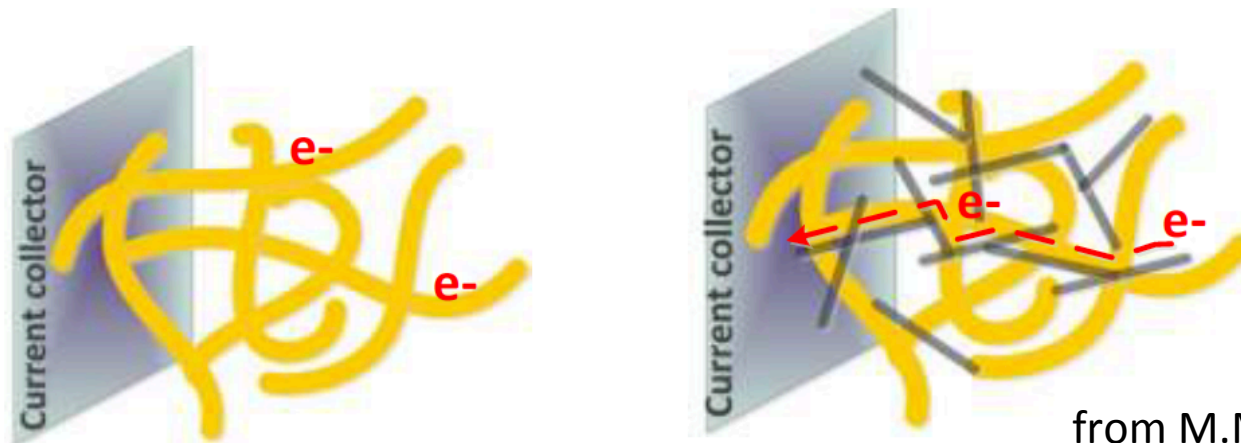


from Dr. Maryam Moradi

How can a phage scaffold improve current batteries?

- Ion diffusivity → nano structuring active material
 - What is the advantage of nano structures?
increase surface to volume ratio
- Electronic Conductivity → integrating additives
 - How do phage improve integration of additives?
screen for binding of additive of interest via phage display

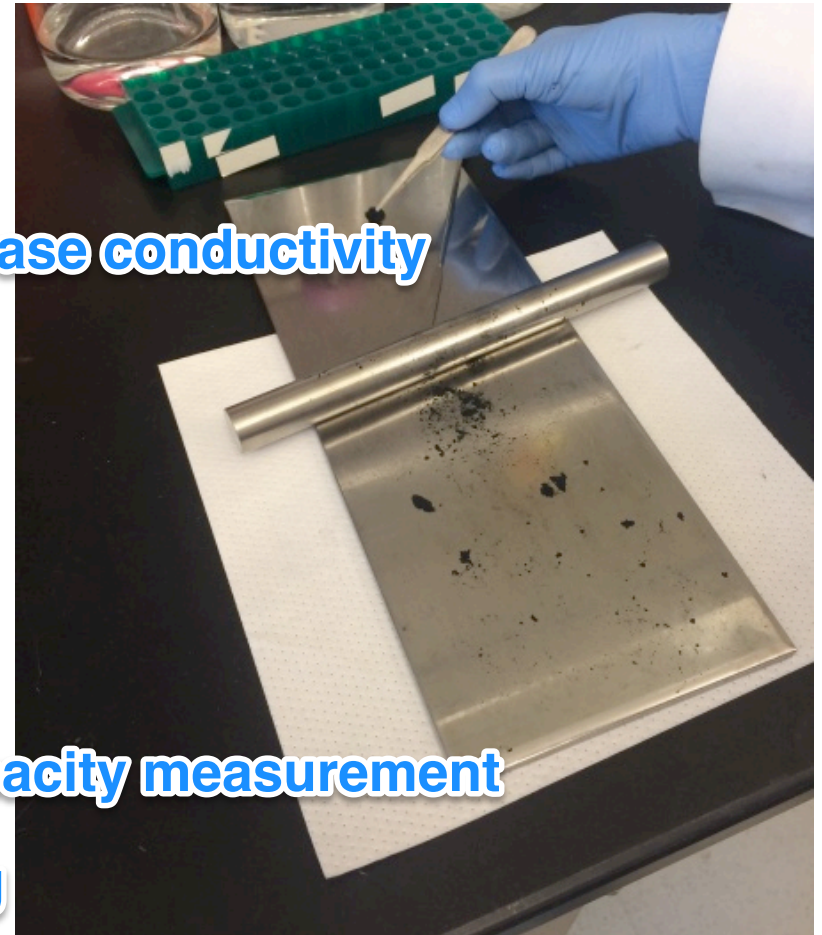
Example: Adding carbon nanotubes to phage cathode



from M.Moradi

How will you construct your cathode?

1. Weigh AuNP-Fe(III)-phage nanowires (active material)
2. Mix with Super P **carbon, increase conductivity** and PTFE **teflon, binder**
3. Roll cathode material into thin sheet
4. 'Punch out' cathode disc
5. Weigh cathode_(why?) **impt. for capacity measurement**
6. Dry cathode_(why?) **increase binding**



Today in lab...

1. Construct cathode Belcher lab
 - bring lab coat and eye protection
 2. Research proposal peer exercise
 - everyone must be the “presenter” and “listener” at least once
 - partner assignments will depend on timing of cathode construction
- M3D4HW: (see slide 2) due 1 week from today.
You cannot make major changes to your proposal idea after this assignment!
- Don't forget about “pitch session” in class next Tuesday