

Post-Test Facility At Argonne

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This poster does not contain any proprietary information

Overview

Timeline

- Project start: April 1, 2010
- Project end: December 31, 2011
- Percent complete: 56%

Budget

- ARRA (DOE) funding: \$2.2M

Objective

- To provide DOE, the US Advanced Battery Consortium and other public- and private-sector sponsors with state-of-the-art forensic information identifying potential cause(s) of performance degradation

Collaborations

- None yet. Expect many once the facility is fully functional



Approach

- Develop and employ standardized tear-down and analysis procedures for evaluating the causes of performance and life limitations in different battery technologies
- Characterize new, aged and abused batteries in terms of:
 - Remaining electrode capacity
 - Electrode morphology, composition and phase distribution
 - Surface chemistry
 - Electrolyte chemistry
- Adapt the Post Test Facility (PTF) hardware as needed to accommodate the unique needs of different technologies
- Addresses Barriers
 - A. Durability
 - B. Abuse tolerance



Post-Test Facility at Argonne

- Battery testing is an on-going program at Argonne. Here, batteries from DOE and USABC projects are objectively evaluated according to a given set of protocols
- Testing provides a lot of information about how battery performance changes with time under a given set of conditions
- Post-test characterization of aged batteries can provide additional information regarding the cause(s) of performance degradation, which, previously, could be only inferred
- Here, the results from physical, spectroscopic, metallographic, electrochemical tests will be used to aid in the further improvement of advanced battery technologies
- The experience and techniques developed in DOE's applied battery program will be used in a standardized fashion, similar to the performance test protocols. This will make comparisons of failure modes within a given technology and, perhaps, across technologies easier
- Facility will be available to help industrial battery developers better understand life-limiting mechanisms specific to their technology
- Similar studies on partially abused cells and batteries could be useful in enhancing the abuse tolerance of advanced battery technologies



Equipment Needs For the Facility

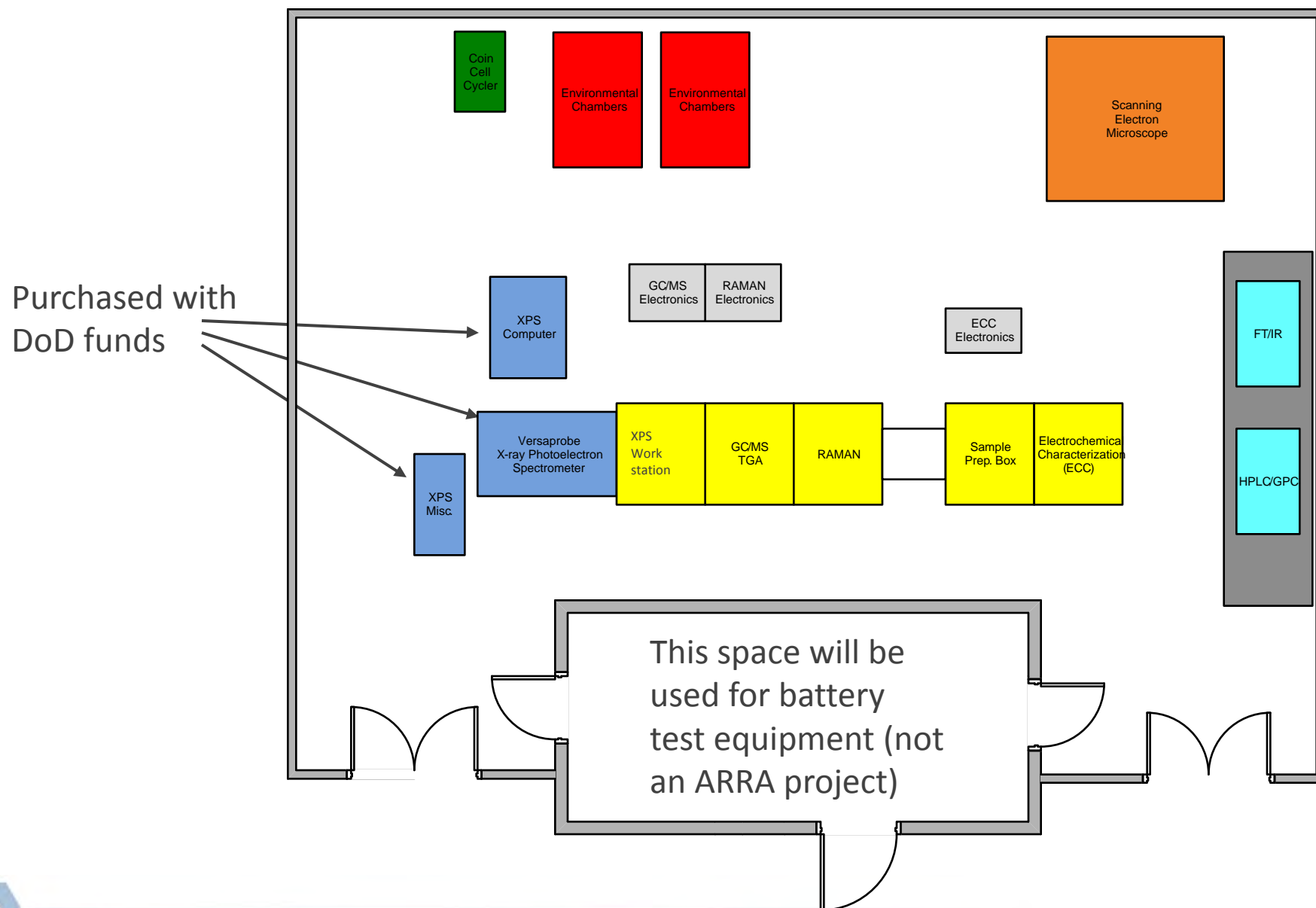
- Identifying degradation modes in batteries, especially lithium-ion batteries, will rely on both bulk- and surface-characterization techniques
- Thus, the needed equipment for the facility includes spectroscopy and surface-science instrumentation
 - FT-IR spectroscopy
 - Raman spectroscopy
 - Optical and scanning-electron microscopy
 - Electrochemical impedance spectroscopy
 - X-ray photoelectron spectroscopy
 - High Pressure Liquid Chromatography/Gel Permeation Chromatography
 - Metallography (optical and SEM)
- Since the aged battery materials may be air-sensitive, they will be handled and characterized in a controlled-atmosphere glove box to the greatest extent possible



Status of Equipment Purchases

Equipment	Purchased?	Delivered?
Custom glovebox	Y	N-delivery is expected on April 15
FT-IR	Y	Y
Raman	Y	Y
Metallography equipment (saws, polishers, grinders, etc.)	Y	Y
Optical microscope	Y	Y
Electrochemical Impedance Spectroscopy (8-ch frequency analyzer and potentiostat)	Y	Y
Low-vacuum SEM	Y	N-delivery is expected in May
XPS	Y	N- delivery is expected on April 18
HPLC/GPC	N – vendor just selected from bidding process	---
Coin cell cyclers	N – waiting for quote	---
Environmental chambers	Y	Y

Laboratory Layout



Facility Development Progress



Renovation of the existing laboratory space is progressing on schedule

Summary

- The PTF will provide DOE, the US Advanced Battery Consortium and other sponsors with state-of-the-art post-test information identifying potential cause(s) of performance degradation
- The PTF will have the ability to characterize the changes in battery chemistry and electrode structure which may impact cell performance and durability
- All post-test examinations will be performed under inert-atmosphere conditions to the greatest extent possible, maintaining the integrity of surface species
- The facility is on-track to open in mid-summer 2011, ahead of schedule

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