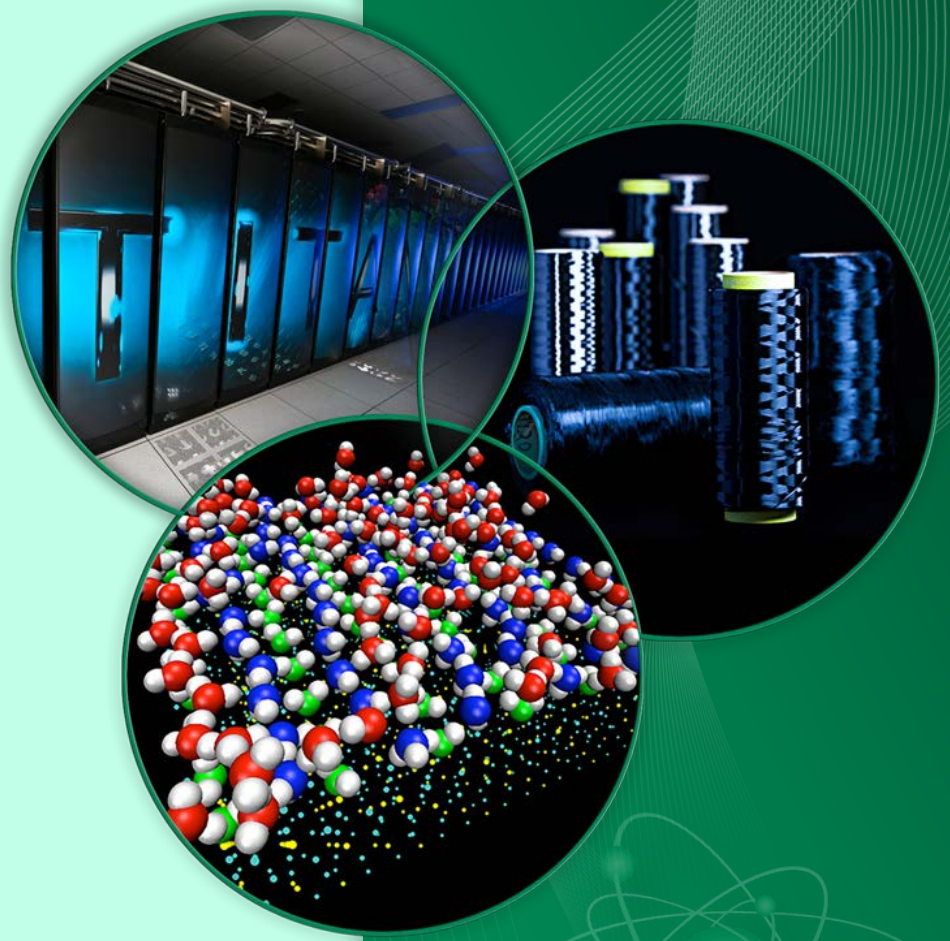
Industrial Collaborations with the ORNL Fuel Cell Technologies Program: Accelerating Widespread Commercialization



David L. Wood, III, Ph.D.

Senior Scientist & Fuel Cell Technologies Program Manager

T2M Event at the 2014 Fuel Cell Seminar

Los Angeles, CA

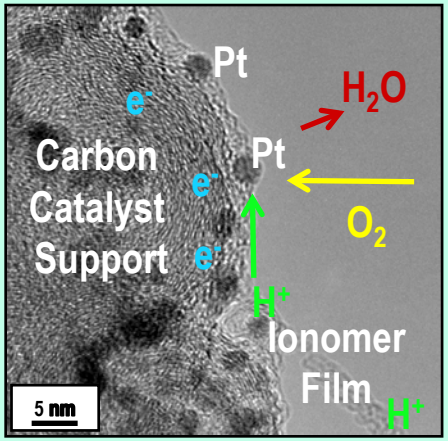
11/11/14

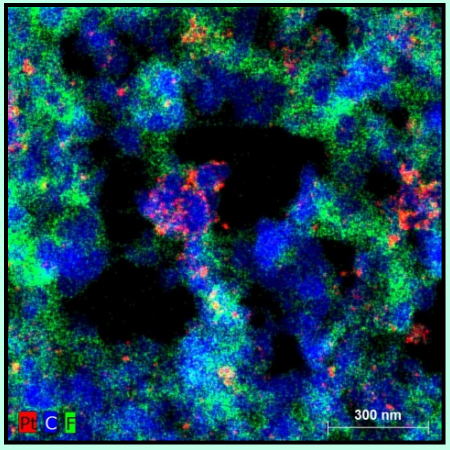
ORNL Overview

- Founded: 1943 as a key Manhattan Project location.
- Location: Oak Ridge, TN
- 4250 Employees
- Budget: ~$1.5B/year
- World-Leading Core Capabilities:
  - Materials characterization
  - Carbon fiber processing and production scale-up
  - Additive manufacturing
  - Neutron scattering at SNS and HFIR
  - Supercomputing
  - Roll-to-roll processing
  - Energy storage and conversion
- 13 PIs and co-PIs in fuel cell components, H_2 delivery, H_2 storage, systems analysis, and safety, codes & standards.

ORNL is enabling transportation fuel cell and hydrogen infrastructure

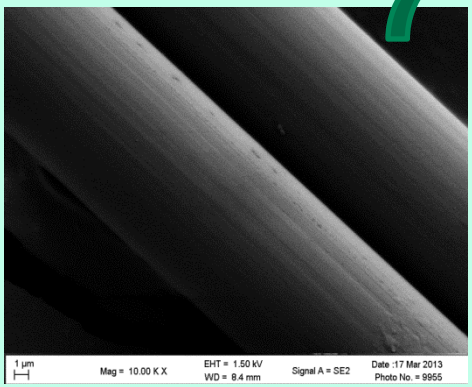
Lower Pt content and improved catalyst durability

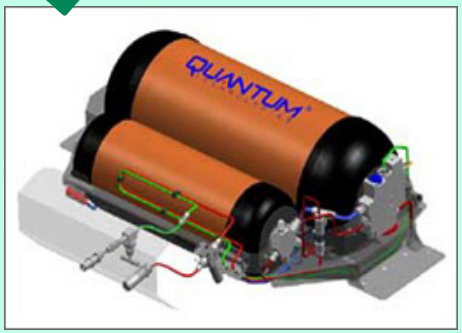


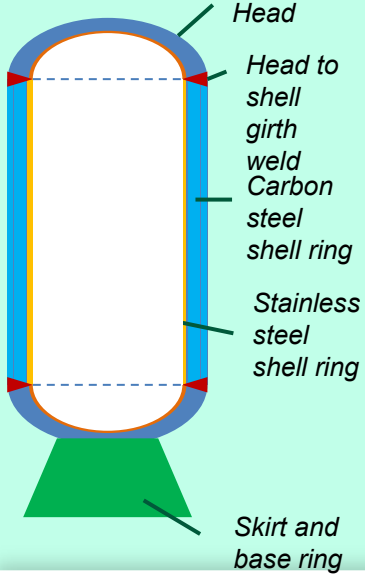


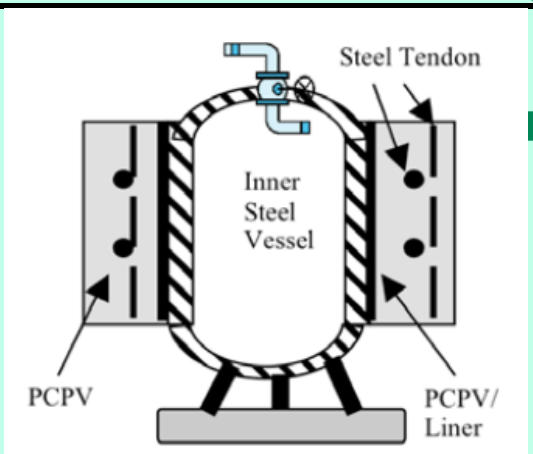
PEMFC triple-phase boundary structural mapping

Low-cost, high-strength PAN carbon fibers for onboard H_2 storage creates potential for 30% cost reduction

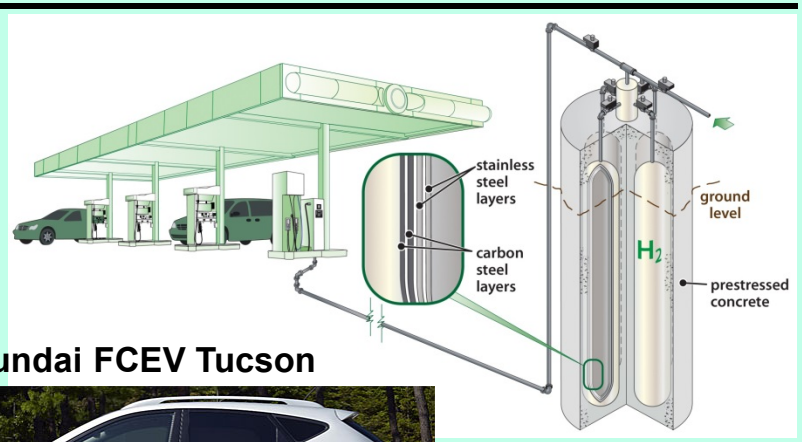








Low-cost, concrete-steel composite underground H_2 storage tanks for FCEV fueling stations



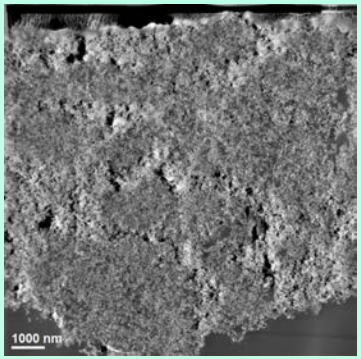
2015 Hyundai FCEV Tucson

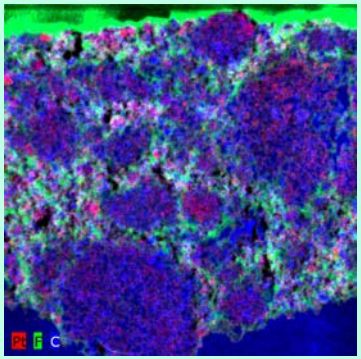
Vehicle introduction and fueling station expansion targeted for Southern California

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE U.S. DEPARTMENT OF ENERGY

Technologies Impacting Fuel Cell Market

- Commercialization of low-cost, corrosion-resistant metallic bipolar plates for PEMFCs and membrane electrolyzers.
- Invaluable materials characterization assistance to MEA makers and OEMs for commercialization of low-cost, durable PEMFC electrocatalysts.





- Low-cost, high-strength carbon fibers for onboard compressed H_2 storage.
- Low-cost underground H_2 storage steel-concrete composite vessels (SCCVs) for hydrogen fueling stations.
- Additive manufacturing capability at the Manufacturing Demonstration Facility (MDF) for low-volume, non-repeating hardware and tooling.
- Spaci-MS in-plane gas analysis of fuel cell reactant and product distribution in BPP flow channels (2008 R&D 100 Award Winner).

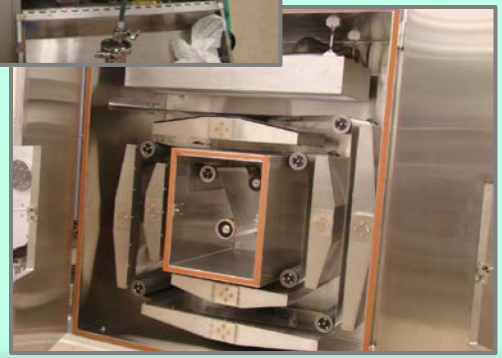
Nanoscale Characterization, Advanced Microscopy, and In-Situ Diagnosics Collaborators

Important Patent Applications and Issued Patents

- Z. Feng *et al.*, US Patent 8,453,515, “Apprarutus and Method for Fatigue Testing of a Material Specimen in a High-Pressure Fluid Environment” (2013).
- Z. Feng *et al.*, US Patent Application 13,940,567, “Hydrogen Storage Container,” July 12, 2013.
- M.P. Brady, H. Wang, and J.A. Turner, “Surface Modified Stainless Steels For PEM Fuel Cell Bipolar Plates“, U.S. Patent 7,247,403 (July 24, 2007).
- M.P. Brady, J. H. Schneibel, B.A. Pint, P.J. Maziasz “Corrosion Resistant Metallic Bipoar Plates” U.S. Patent 7,211,346 (May 1, 2007).
- M.P. Brady, B. Yang, and P.J. Maziaz, US Patent 7829194 Iron-based alloy and nitridation treatment for PEM fuel cell bipolar plates” (November 9, 2010).

Opportunities for New Industry-ORNL Collaborations

- ***Industry-leading*** contribution to cheaper, more accessible H_2 filling stations.
- ***World-class*** carbon fiber processing (Carbon Fiber Technology Facility, etc.) for lower-cost FCEV H_2 storage tanks.
- ***State-of-the-art*** additive manufacturing (metal powder, metal sheet, and CF-composite processing) for component prototyping and non-repeating hardware.
- ***Novel, ultra-high conductivity*** anion exchange membrane (AEM) development for AFCs.
- Continued contributions to improved electrocatalyst durability through ***world-class*** microscopy and chemical analysis capabilities.
- ***Game-changing***, low-cost corrosion protection for stamped metallic bipolar plates.
- ***Novel*** coating and drying methods and equipment at one-of-a-kind DOE Battery Manufacturing Facility at ORNL (BMF) for MEA and GDL production.



Contacts

- David L. Wood, III
  - ORNL Fuel Cell Technologies Program Manager
  - Phone: 865-574-1157
  - Email: wooddl@ornl.gov
- Ronald L. Graves
  - Director, ORNL Sustainable Transportation Program
  - Phone: 865-946-1226
  - Email: gravesrl@ornl.gov