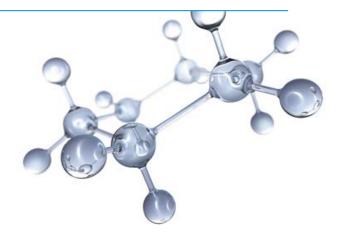


Materials Genome Initiative Grand Challenges and Perspective



Dr. Hugh Helferty Manager, Global Chemicals Research November 19, 2013

"To help businesses discover, develop, and deploy new materials twice as fast, we're launching what we call **the Materials Genome Initiative**.

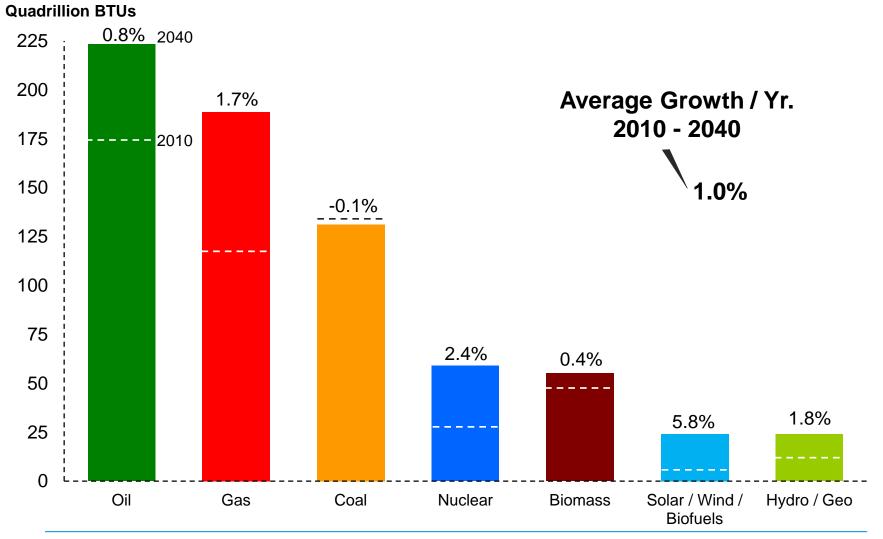
The invention of silicon circuits and lithium ion batteries made computers and iPods and iPads possible, but it took years to get those technologies from the drawing board to the market place. **We can do it faster.**"

-President Obama (6/11)

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Oil and Gas Remain Leading Energy Sources





ExonMobil Chemical

Importance of Materials to ExxonMobil



Automobiles

- Material integrity is critical to protect people and the environment
- Advanced materials are essential to our business
 - Enable operations under a wide range of conditions
 - Enable chemical reactions and separations
- ExxonMobil Chemical produces millions of tons of materials that our customers use to make products



Plastics







- How to design structural materials to enable performance under increasingly harsh conditions?
- How to enable hydrocarbon separations that are much more energy efficient?
- How to predict and control the properties and performance of polymers and polymer mixtures?





Observations on Materials Challenges

- A product often incorporates multiple materials that form a system
- The effectiveness of a material depends on its interaction with other materials
- Accelerating the pace of materials-based side with innovation hinges on understanding interactions as much as speeding up discovery

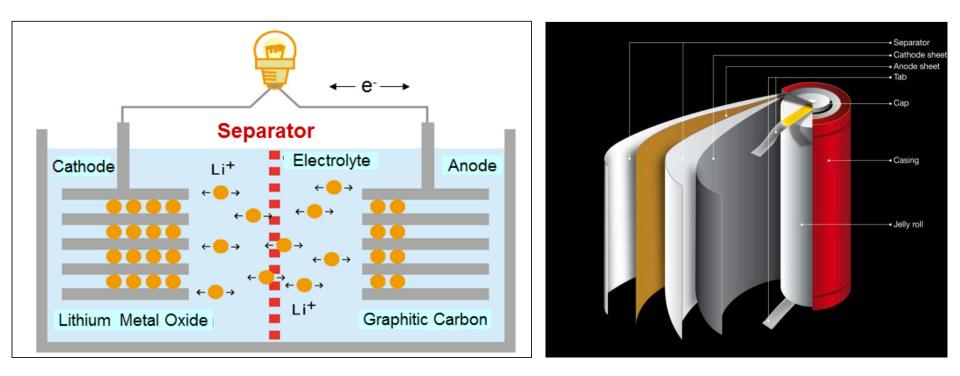








Basic Components in Lithium-Ion Battery



• From lab to commercial product requires many innovations



Lithium-Ion Battery Development History mid-1970's Li-ion battery proposed - Whittingham, Exxon Corporate Research Critical cathode innovation 1979 - Goodenough and Mizushima, Oxford U Critical anode innovations 1980, 1985 - Yazami, Yoshino Critical separator innovation 1991 - Tonen Chemical (affiliate of Exxon and Mobil) 1991 First commercial Li-ion battery - Sony Li-ion cell production exceeds 1 billion units 2003







• The Materials Innovation Infrastructure needs to be designed in a way that accelerates not just material development but also system (or product) development; material interactions are critical

- Essential to significantly reduce time-to-market

- Future material scientists and engineers needs to understand not just how to create a material but how materials can be integrated to form a useful system
 - Implications for science/engineering education

