



Hello North Shore Students

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Introduction

- Name: Marc W. Bird
- Year: First year PhD student – University of Houston
- Major: Material Science and Engineering
- Research:

Materials Design of Ultrahigh Temperature
Ceramics for Improved Mechanical Behavior
in Oxidizing Environments



Background: General

- Born in Greeley Colorado

- Cities lived in: 

- Hobbies:

- Sports: Baseball, Ice Hockey, Golf, Football, Snow Boarding, various other outdoor activities.

- Wood working, metal working (coming soon!)

- Recently married to my wife Jennifer

- Graduated from University of Houston Optometry School.



Background: Undergraduate Studies

- Attended Colorado School of Mines – Golden, CO
- Major: Materials and Metallurgical Engineering
- Graduated in 2006
- Activities during undergrad:
 - Member of Sigma Alpha Fraternity (SAE)
 - Member of CSM Baseball Team (RMAC, DIV II)
 - Participated in Freshmen orientation programs
 - Member of MSEC (Material Science and Engineering Club)
 - Studied Abroad in Australia – Wollongong, NSW



Background – Professional Career

- Hired on at Baker Hughes Inc. in 2006.
 - Oil and gas servicing company – drill bit manufacturing.
 - Worked four years as a Materials Engineer.
 - Experience:
 - Learned practical applications of basic and advanced concepts in metallurgy, general science & engineering principles.
 - Networked with people all over the world.
 - Learned tricks of the trade in the oil industry



GREAT MONEY \$\$\$

Background – Graduate Studies

- Started 2008 as part time master's student at University of Houston
- Put my career on hold to pursue a PhD in Material Science.
- What is Material Science?
 - Solid state chemistry
 - Liquid state chemistry
 - Gas chemistry
 - And Much More – Mechanics and Physics
- Research:



**Materials Design of Ultrahigh Temperature
Ceramics for Improved Mechanical Behavior
in Oxidizing Environments**

Research

- Research is sponsored by Air Force Office of Scientific Research.
- What are Ultrahigh Temperature Ceramics (UHTC's)?
 - Metal-nonmetal, Covalent bonded compounds ($\text{ZrB}_2 - \text{SiC}$)
 - High melting point materials; strong materials at temperature; excellent oxidation resistance

Research

Where are these materials used?

Structural materials for use in hypersonic aircraft – Next generation reentry vehicles



Why do you think the space shuttle is shaped the way it is?

To reduce the amount of heat generated upon reentry.



UHTC materials can change the shape of next generation space planes because of unique combinations of properties



Research

I am responsible for completing experiments on various grades of UHTC materials to characterize specific mechanical properties up to $\sim 1800^{\circ}\text{C}$ (1/3 the sun surface temperature).....

That's HOT!!!!

Research

- I have mentioned many different technical terms from my research. I want to see how much you know.

What is a Metal or Nonmetal?

- *Metal is good conductor of electricity and heat – Positive valence in ionic form*
- *Non-metal is a poor conductor of electricity and heat – Negative valence in ionic form.*

What is a covalent bond?

- *Sharing of electron pairs between atoms*

What elements make up ZrB₂-SiC?

- *Zirconium (Zr), Boron (B), Silicon (Si), Carbon (C)*

What does the melting point represent?

- *Temperature where vapor pressure of solid and liquid are equal. Solid and liquid phase are in equilibrium*

What is oxidation?

- *Reaction with oxygen where electrons are lost*

- These are all related to chemistry!!!
- What you are going to learn are some basic principles behind my research and material science.

Closing Thoughts

- What Science and Engineering has done for me.
 - I have had the opportunity to travel the world.
 - Meet people from all over the world – Including my best friends.
 - Work for a company based in 90 countries.
 - Develop new skills:
 - Technical – Engineering, Research
 - Personal – Effective communication

Closing Thoughts

- What science and engineering can do for you.
 - Further your education.
 - Pay your way to college.
 - Have the fun, social experiences in college.
 - Get a well paying job that can allow you to travel the world.
 - World wide networking – Business and Professional Societies.

Closing Thoughts

- There are many technical challenges ahead of us, as a society, and more engineers and scientists are needed.
- How does this involve you? We will always need to maintain and improve human society while repairing and protecting the environment.
- Where does all of this begin? Chemistry Class!!.

“Without continual growth and progress, such words as improvement, achievement, and success have no meaning.” – *Benjamin Franklin (1706 – 1790)*

