

Thermal and Mechanical Characterization of C/C Composite Produced via Highly Processable BODA- Derived Precursor Resin System

ASE Senior Seminar Proposal

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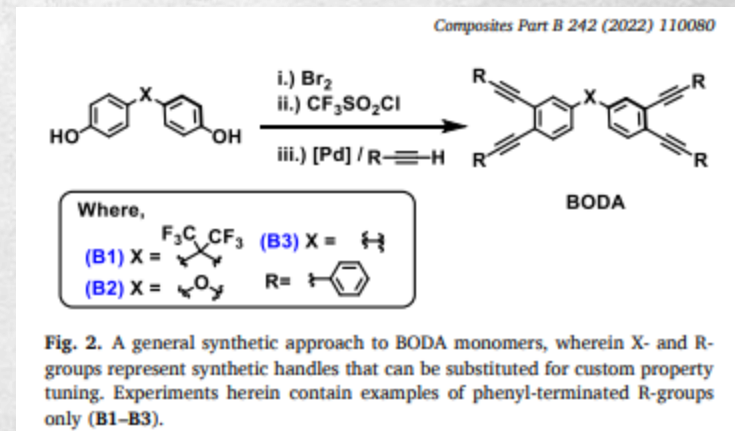
Background

Carbon/Carbon (C/C) Composites

- High-Temperature Extreme Material
 - (1000°C, Under Inert Atmosphere)
- Hypersonic Leading-Edge Application
- Long Processing Times (~9 months) due to slow curing processes from industry precursor resin technology
- Time = 's Money

BODA-derived Resin (BDR) Precursors

- Alternate Precursor Formulation
- Reduced Processing Time (~3 days)
- Variable Processability
- Thermomechanical Non-validation



<https://doi.org/10.1016/j.compositesb.2022.110080>

BODA = Bis-ortho-diynearene

Proposed Problem Statement

Problem Statement:

- The industry standard for carbon/carbon composites is phenolic resin, which is low char(carbon) yielding and very time consuming(9 months) to form C/C structures. The proposed Bis-ortho-diynylarene (**BODA**) precursor resin system seeks to solve both low char yield(>80%) and long processing times(down to 3 days) while maintaining high processability and high post cure mechanical properties. To do this, test coupons will be made, their mechanical properties will be tested, and then compared against industry standards.

Proposed Objectives

1. Produce Carbon/Carbon composite coupons using the BODA-derived precursor resin system.
2. Preform testing in the following areas:
 - Compression Molding
 - Dynamic Mechanical Analysis
 - Tensile Testing
 - Thermal Cycling
 - Scanning Electrons Microscope
3. Compare mechanical and thermal characteristics of the Carbon/Carbon composite produced to industry standard composites.
4. Creation of website to present the data collected and gathered conclusions

Advisors

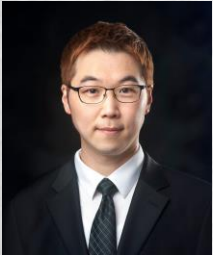


Ernesto Borrego, Ph. D. - *HAND Technologies LLC*

- CEO of Hand Technologies, Mississippi State University Alumni

Expertise:

- BODA-derived Precursor Resins and Carbon/Carbon Composite Manufacturing



Han-Gyu Kim, Ph. D. - *Mississippi State University ASE Dept.*

- Assistant Professor of Aerospace Engineering

Expertise:

- Hypersonic Material Damage Testing and Modeling

Project Timeline

Present plan including

- *Project deliverables and due dates in format -- mm/dd*
 - Down Selection of Resin Formulation - **09/20**
 - Test Coupon Manufacturing Completed – **10/10**
 - Rheology completed - **09/30**
 - Initial SEM Scans – **09/30**
 - Thermomechanical Testing Begins – **10/15**
 - Thermomechanical Testing Ends – **11/15**
 - Technical Write-up Reviews with Advisors – **11/15**

Questions?