Team Members: James Armstrong, Joshua Brown, Joshua Griffin, Patrick Madden

Faculty advisors: Ernesto Borrego, Ph.D.

Han-Gyu Kim, Ph.D.

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

## Problem Statement

This project seeks to characterize the Carbon/Carbon (C/C) Composites derived from Bis-ortho-diynylarene precursor resin system. We seek to highlight the high processability of this precursor resin system and shortened manufacturing times and confirm the quality of student fabricated C/C composite materials via mechanical and thermal characterization. We will characterize Young's modulus, shear modulus, Poisson ratio, coefficient of thermal expansion, and other mechanical and thermal properties to compare to industry standard C/C composites.

## Overall Project Objective(s)

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

**Individual Team Member Responsibilities**

Josh Brown – Project Lead

- In charge of coordinating experiments between faculty and industrial advisors
- Responsible for scribing during advisor meetings, sending out weekly meeting minutes, making room reservations when necessary
- Responsible for preforming scanning electron microscopy on the samples
- Responsible for leading operation of thermal cycling testing
- If necessary, shall be responsible for characterizing pyrolyzates via Pyro-GCMS
- Technical expert

Patrick Madden – Coupon Manufacturing Lead

- In charge of curation of test coupons and transition from manufacturing to materials testing
- Responsible for ensuring sufficient quality of manufactured test coupons
- Responsible for composite density characterization
- Will assist in the thermal testing of the coupons
- Technical expert

Joshua Griffin – Lead Technician and Investigator

- In charge of leading the operation of mechanical testing
- Responsible in managing experimental deadlines
- Responsible for testing viscosity of precursor formulations with the BODA precursor resin system
- Will assist in the manufacturing of the coupons
- Responsible for any SolidWorks modeling

James Armstrong – Website Development Lead

- In charge of development and organization of the project's webpage
- Responsible for ensuring proper data is shared and consented to as willed by Hand Technologies, LLC.
- Will assist in the manufacturing of the coupons
- Will assist in the mechanical testing of the coupons

## Reporting

Our team will meet with Hand Technologies LLC. every Friday at 2:00 p.m. to discuss weekly goals and project results. As we progress through the semester, meetings with Dr. Kim will be more frequent and scheduled on a weekly need-to-need basis, primarily during the thermomechanical material testing phase of the project.

### Signatures

Those parties who willfully present their signatures on this document attest that they have read and understand all of the requirements and expectations presented above both explicitly and implicitly. This document represents a promise by the students to perform the task outlined above to the best of their ability. It is the responsibility of the course instructor and faculty advisor to understand the problem description outlined above and to require the students to abide by this statement of work.

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| Han-Gyu Kim, Ph.D.<br><br>Signature _____ Date _____ |
| Ernesto Borrego, Ph.D.<br><br>Signature _____ Date _____ |
| Joshua Brown<br><br>Signature _____ Date _____ |
| Patrick Madden<br><br>Signature _____ Date _____ |
| Joshua Griffin<br><br>Signature _____ Date _____ |
| James Armstrong<br><br>Signature _____ Date _____ |