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

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Problem Statement & Objectives

What?

Bis-ortho-diynylarene (BODA)-derived carbon precursor resin is a promising technology that can theoretically cut production times of Carbon/Carbon (C/C) composites from months to days. The goal of this project is to use compression molding to create a BODA-derived C/C composite and characterize mechanical properties to compare with current industry standards.

Characterize:

- Material Properties (Young's Modulus, Shear Modulus, Poisson's ratio, etc.)
- Pyrolyzates during curing and carbonization processes
- Viscosity of resin formulation
- Ease of manufacturing

Background & Motivation

Why?

- Carbon/Carbon Composites have been commercialized for decades; however, they are plagued with long manufacturing times and inconsistencies due to decades old precursor resin formulations (i.e. Phenolic resins and mesophase pitches).
- BODA monomers convert to carbon efficiently and can carbonize under rapid heating rates (10°C/min) with minimal weight loss.
- Composites made from BODA-derived resins (BDR) have yet to be mechanically tested and validated

Methodology

How?

- Prepare 5 test coupons with dimensions "180mm x 13mm x 1mm" via compression molding
- Model and fabricate molds using SolidWorks and 6061-T6 Aluminum
- Measure density of fabricated composites
- Scanning Electron Microscopy for verification of wettability and matrix voids
- Perform tensile testing to determine Young's modulus, Poisson's ratio etc. to compare to standard C/C composite, ACC6
- Perform thermal cycling testing to determine material thermal resistance and fatigue to again compare to ACC6

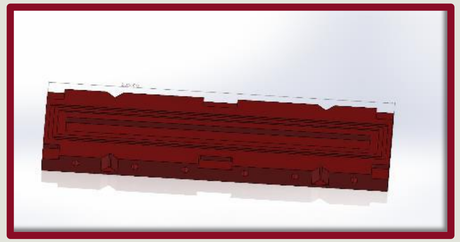

Fig.1 Female Mold made from Aluminum 6061-T6

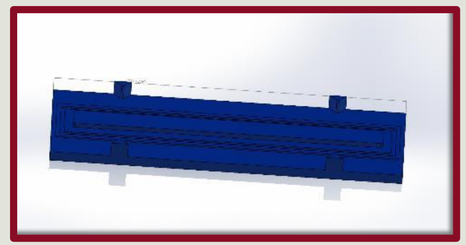

Fig. 2 Male mold made from Aluminum 6061-T6

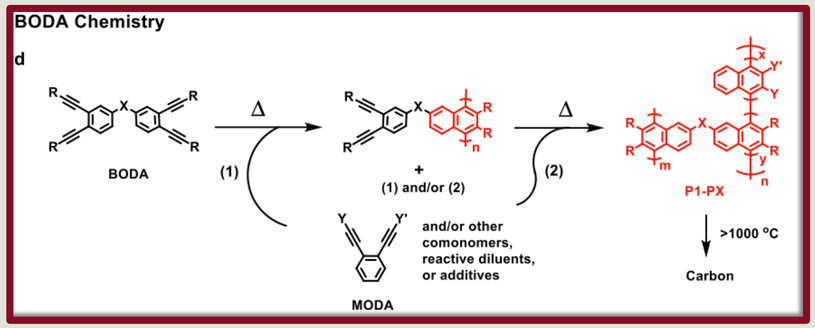

Fig. 3. General polymerization, crosslinking, and carbonization of Bis-*ortho*-diynylarene (BODA) monomers with or without comonomers or additives before (1) or after B-staging of the resin (Borrego et. al. 2020)

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