Preparation and Testing of Low Cost Carbon-Carbon Composites for High Temperature Applications

Oluwatobi Busari oobusari@buffalo.edu, *Professor Deborah Chung ddlchung@buffalo.edu

* Faculty Advisor

**Objective**
The objective of this project is to evaluate the improved C-C composites in terms of the ability of to withstand high temperatures and compare this ability with that of conventional carbon materials.

**Improved C-C composites**
As shown by Professor Chung, improvement of C-C composites can be obtained by the incorporation of an organoclay filler.

**Introduction**
These are the primary materials used in the manufacture of structures built to withstand high temperatures. Such structures include missile exit cones, skin for military aircraft, aircraft brake discs, among others.

**Problems with C-C Composites**
Despite their attractive qualities, a limitation of these materials is high cost of production. One prominent procedure driving this cost is densification. They also exhibit limited oxidation resistance.

**Thermal degradation mechanism investigation**
The thermal degradation mechanism will be studied by examination of the microstructure after mechanical polishing using an optical microscope. Such observation will be made before and after heating in order to see how the microstructure changes due to thermal degradation.

**Method and Implementation**
The evaluation of the ability to withstand high temperatures (up to about 750°C in air) will be conducted by measuring the weight of the specimen as the temperature is increased at a controlled rate (e.g., 5°C/min). The weight will also be measured during subsequent cooling at a controlled rate. This method is known as thermogravimetric analysis (TGA).

**Composite fabrication**
C-C composites will be fabricated by hot pressing at temperatures up to about 1000°C and pressures up to about 25 MPa in the presence of a nitrogen gas purge.

**Future Work**
- Preparation of C-C composites by hot pressing.
- Thermogravimetric analysis of C-C composites.
- Microscopic analysis of C-C composite after thermal degradation.

**TGA Results**
Various conventional carbon materials have been evaluated in terms of their ability to withstand high temperatures. This information is valuable for serving as reference data in the follow-on evaluation of the C-C composites.

**Metallographic Results**
Micrographs of fine grain graphite

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**References**