Processing and Characterization of Basalt Fiber Reinforced Ceramic Composites for High Temperature Applications Using Polymer Precursors

Sarah Cox
Donovan Lui
Dr. Jihua Gou
Department of Mechanical and Aerospace Engineering
University of Central Florida
Orlando, FL, USA

The development of high temperature structural composite materials has been very limited due to the high cost of the materials and the processing needed. Ceramics can take much higher temperatures, but they are difficult to produce and form in bulk volumes. Polymer Derived Ceramics (PDCs) begin as a polymer matrix, allowing a shape to be formed and cured and then to be pyrolized in order to obtain a ceramic with the associated thermal and mechanical properties. The two PDCs used in this development are polysiloxane and polycarbosilane. Polysiloxanes contain a silicon oxycarbide backbone when pyrolized up to 1000°C. Polycarbosilane, an organosilicon polymer, contain a silicon-carbon backbone; around 1200°C, β-SiC begins to crystallize.

The use of basalt in structural and high temperature applications has been under development for over 50 years, yet there has been little published research on the incorporation of basalt fibers as a reinforcement in composites. Basalt is a naturally occurring material found in volcanic rock. Continuous basalt fiber reinforced PDCs have been fabricated and tested for the applicability of this composite system as a high temperature structural composite material. Thermal and mechanical testing includes oxyacetylene torch testing and three point bend testing.