NOVEL POLYMER-DERIVED CARBIDE AND BORIDE REFRACTORY CERAMICS

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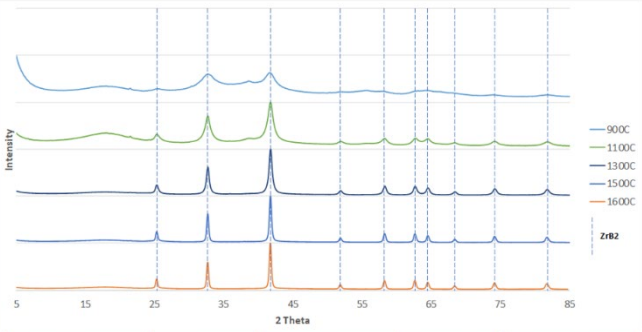
While ceramic matric composites (CMCs) are just starting to find broader application in the aerospace and energy generating industries, the increasingly aggressive environments to which they are being pushed have already started exposing some of the limitations of the current generation of material systems being utilized for composite manufacturing. Among the major deficiencies, one of the most striking is the scarcity of precursor options for non-oxide matrix formation – both in terms of supplier base, and in chemistries capable of performing in oxidizing conditions at temperatures above 1600°C. This work will present the results from a recent effort focused on the development of single source polymeric precursors for Ultra High Temperature Ceramics (UHTCs), specifically targeting hafnium and zirconium carbides and borides, to be utilized during the processing of CMCs and refractory coatings. The characterization of the precursor's processing properties in terms of ceramic product yield, composition, conversion and crystallization behavior, as well as the potential for shaping via solution-based methods will be presented. To evaluate the feasibility for PIP processing, the results from a preliminary carbon fiber mini-composite study will be discussed. Additionally, routes to convert excess carbon in the pyrolyzed precursor into additional UHTC content are also explored, and the results presented.



Condition	Yield (wt%)	Overall Yield (wt%)	C (wt%)	Ceramic (wt%)
600 °C	89.5	89.5	--	--
1500 °C, 0d	94.0	84.1	40.4	43.7
1500 °C, 3d	96.3	86.2	--	--
1500 °C, 6d	97.3	87.1	38.2	48.9

Figure 1. Crystallinity evolution and ceramic yield of synthesized precursor (ZrB_2)