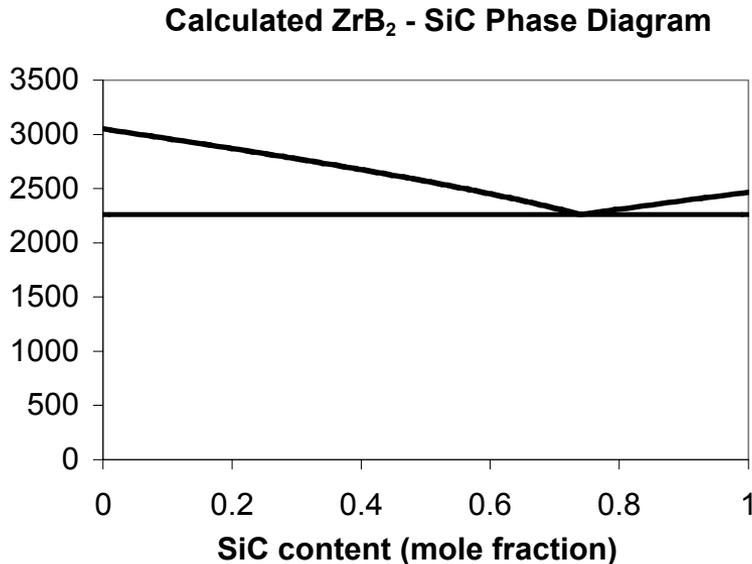


Reactive Processing of High Temperature Materials

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DMR 0403004

Ultra-high temperature ceramics (UHTCs) have been proposed for use in extreme environments such as thermal protection systems for future aerospace vehicles (e.g., potential space shuttle replacements or hypersonic vehicles). UHTCs promise strength at high temperature, thermal shock resistance, and oxidation protection.



ZrB_2 -SiC phase diagram
calculated by Alireza Rezaie

Concept for a
hypersonic
aerospace vehicle
courtesy of NASA



Technical Progress

Phase diagrams are essential tools for materials engineers, providing information about processing conditions, environmental stability, and compatibility with other materials. Existing diagrams for many UHTCs are unreliable due to difficulties in measuring ultra-high temperatures, impurities in starting materials, or the number of specimens examined. For this project, several methods have been used to calculate ZrB_2 -SiC binary diagrams. Experimental verification of these diagrams is now underway.

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Due to the needs of our constituents, recruiting quality graduate students is a top priority of the Ceramic Engineering program at University of Missouri-Rolla. Several methods for identifying and recruiting potential students from non-traditional backgrounds are being explored. One method under consideration is to focus on students in chemistry and physics programs at small liberal arts colleges who would normally not be exposed to opportunities related to materials research.

Broader Impact

Robyn Goacher, an undergraduate chemistry major from a college of less than 600 students, spent her summer in at UMR. She built equipment and investigated the high temperature mechanical strength of ZrB_2-SiC . Robyn designed and built an apparatus for making v-notches in bend bars for determination of fracture toughness by fracturing single-edged, v-notched beams. She also designed an apparatus for measuring thermal diffusivity in small specimens.



Robyn and the device she built for preparing SEvNB fracture toughness specimens

Blade that cuts notch

Ceramic specimen on sliding table

Washer for size comparison (1 inch diameter)

