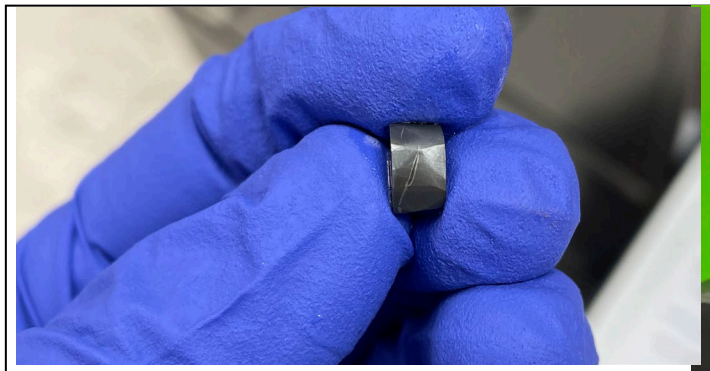
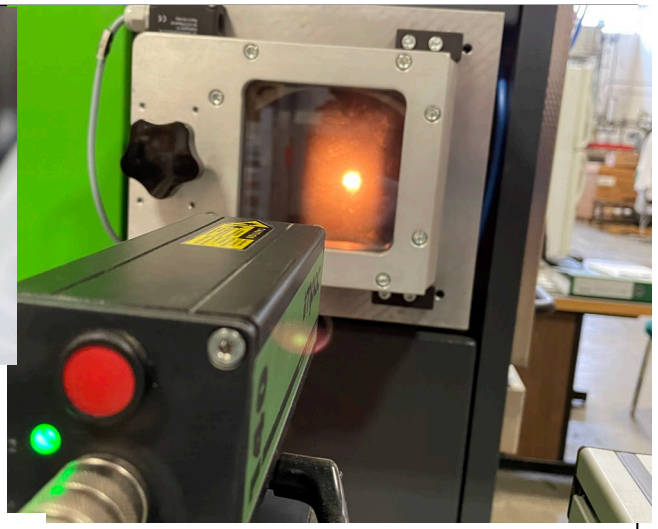
Spark Plasma Sintering and Characterization of Boron Carbide

Yogesh K. Vohra, University of Alabama at Birmingham

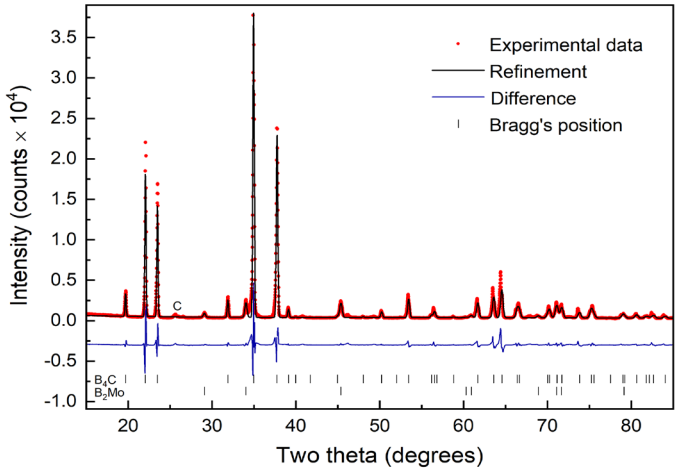
The boron-rich boron-carbide materials are of interest because of their high strength and abrasion resistance applications, high neutron absorption cross section in nuclear reactor control applications, and its incorporation in the fabrication of light weight composites in body armor applications.

- Boron-carbide material ($B_{4.5}C$) was synthesized by spark plasma sintering at 1930° Celsius
- X-ray diffraction revealed a hexagonal structure with lattice parameters *a* = 5.609 ± 0.007 Å and *c* = 12.082 ± 0.02 Å.
- Nanoindentation measurement yield a hardness value of 29 GPa
- Thermal oxidation in air indicate weight gain of less than 0.1 mg/mm^2 up to 1300° Celsius better than traditional ceramic materials





Spark plasma sintering of boron and carbon mixtures at 1930° C. Handheld synthesized sample shown above



X-ray diffraction of the synthesized sample showing primarily a hexagonal single phase with a composition of $B_{4.5}C$.

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In 2023, we recruited ten REU-site participants including 60% participation from underrepresented minority groups and offered projects in (1) materials under extreme conditions (2) machine learning and simulations in materials research, (3) Infrared Lasers and Spectroscopy and (4) polymeric biomaterials and capsules for drug delivery applications.

Wesley Sutton is a senior physics major at the Georgia College and State University and worked on the spark plasma sintering of boron-carbon mixtures during summer 2023.

2023 Summer Research Experiences for Undergraduates (REU)-site participants on UAB campus