Stabilization of a Dissimilar Rare-Earth Boride in High-Entropy $(Ti_{0.2}Zr_{0.2}Hf_{0.2}Ta_{0.2}Er_{0.2})B_2$ with Enhanced Hardness and Grain Boundary Segregation

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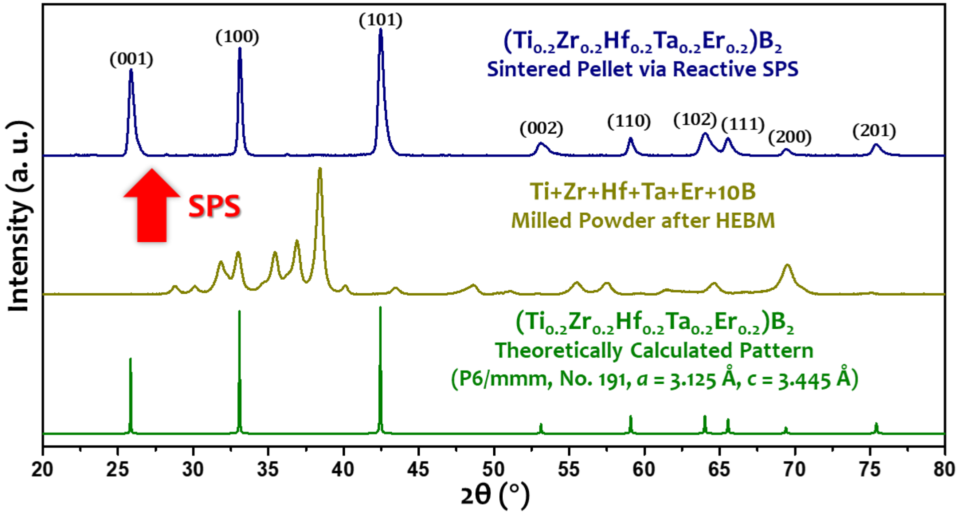
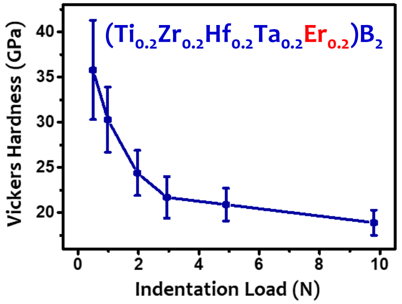
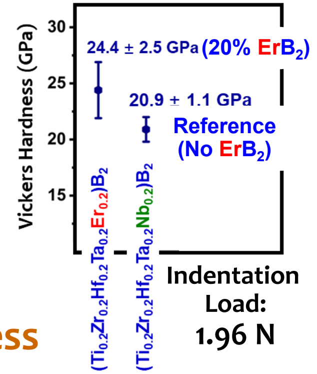
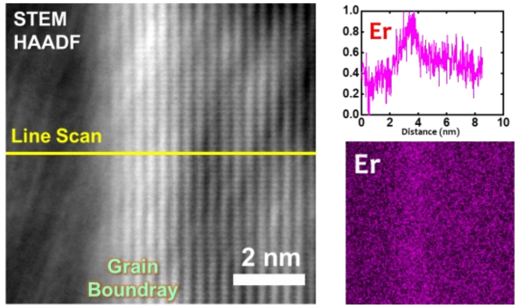
- In IRG-1, we showed that high-entropy ceramics can have significant solubilities of dissimilar components that can subsequently enable new, tunable, and improved properties.
- **20% ErB_2** can be stabilized in a **high-entropy transition metal diboride**, despite the dissimilar chemical properties of rare earth and transition metal elements and large differences in their atom/cation radii.
- Single-phase **$(Ti_{0.2}Zr_{0.2}Hf_{0.2}Ta_{0.2}Er_{0.2})B_2$** achieved via boron-metal reactive spark plasma sintering (SPS)
- Phase formation in $(Ti_{0.2}Zr_{0.2}Hf_{0.2}Ta_{0.2}Er_{0.2})B_2$ depends on the fabrication route.
- The rare earth addition enhances the hardness of $(Ti_{0.2}Zr_{0.2}Hf_{0.2}Ta_{0.2}Er_{0.2})B_2$.
- Larger Er atoms segregate at grain boundaries, which can influence microstructural evolution.







Enhanced Hardness



Grain Boundary Er Segregation

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