ADDRESSING NATIONAL NEEDS

The Enabling Materials for Extreme Environments signature area addresses national needs related to clean energy production, hypersonic flight, advanced propulsion systems, and other stresses that are beyond the capabilities of current structural materials.

• **Solar power.** New materials will make solar energy less expensive by increasing the operating temperature of solar collectors and producing more robust components.

• **Nuclear fusion.** Improved materials can withstand the extreme temperatures, chemical reactivities and radiation of plasma-facing structures.

• **Nuclear fission.** Improved materials increase safety in conventional nuclear power systems.

• **Generation IV nuclear reactors.** Inert matrix fuels and structural components increase reliability.

• **Hypersonic flight.** Sharp leading/trailing edges and control surfaces help enable global reach, reduce time-to-target and increase cross range of weapons systems.

• **Scramjet propulsion.** Reducing weight and increasing operating temperature through ultra-high-temperature ceramics will improve efficiency and simplify designs.

KEY RESEARCH CENTER

Enabling Materials for Extreme Environments includes collaborators in chemistry, materials science and engineering, mechanical and aerospace engineering, nuclear engineering, and physics. This team draws heavily on the resources of Missouri S&T’s Materials Research Center. The MRC is the longest-standing research center on campus and has a history of fostering interdisciplinary collaboration and technology transfer. The MRC provides major research instrumentation including X-ray diffraction, scanning electron microscopy, dual-beam focused ion beam milling and electron imaging, transmission electron microscopy, and X-ray photoelectron spectroscopy.

EXCEPTIONAL FACULTY AND FACILITIES

Signature area leaders have collaborated for over 10 years on ultra-high-temperature structural ceramics for aerospace applications. Their research has amassed a unique collection of highly specialized equipment, including several high-temperature furnaces, a mechanical testing system for measuring strength and elastic modulus up to 2600°C, and a thermal property analysis system capable of operating up to 2800°C. The quality and impact of this research is recognized around the globe. Recruiting additional faculty in this signature area will create long-term growth and widen the impact of the research.