Processing of Metals, Ceramics, and Composites by Field Assisted Sintering Technology (FAST) for MHD Power

Professor Jogender Singh’s Research Group
Phone: 814-863-9898, E-mail: jxs46@psu.edu

Field Assisted Sintering Technology
Field assisted sintering technology (FAST) is an emerging manufacturing technology, where heating rate as high as 1000°C/min are achieved by the simultaneous application of pressure, high temperature and high density pulsed current. In FAST, volumetric heating leads to dense compact with fewer defects at temperatures that are 200 to 250 °C lower than the temperatures used during conventional sintering. FAST is a promising solution in processing high temperature materials or composites with minimal grain growth.

Applications
- Aerospace Industry & Hypersonic Vehicles
- Cutting Tool
- Sensors & MEMS
- Human Protection
- Solar Cells, MEMS
- Therma-electric Materials
- Thermal Management Materials for Microelectronics
- Medical & Bio-medical

Research Activities
Light Weight Metals / Alloys
Ti-6Al-4V with Boron Addition Processed via Field Assisted Sintering
FAST Ti-6Al-4V with 1.6 wt. % B addition reduced the average grain size of FAST Ti-6Al-4V from 600 mm to 100 mm. The resulting material is 20% harder and 16% stronger than the commercially rolled Ti-6Al-4V.

Hybrid Thermal Management Materials
Copper Alloy with Diamond Consolidated via FAST
Tailored hybrid heat sink components with 10% diamond fabricated in one step. Technology ready to be transferred to industry.

Effect of TGP Addition on the Thermal Conductivity of Graphite/Aluminum Composite

Refractory Metals
- Tungsten and tantalum were sintered to ~99% density without any additives.

Joining of Single Crystal Nickel-Based Superalloy for Gas Turbine Propulsion
Joining of Low Density Single Crystal (LDS) and Poly Crystalline Low Solvus High Refractory (LSHR) Nickel Superalloy

Summary
Variety of materials and composites have been produced successfully by FAST. Superior properties have been observed. This technology would expand the horizon of new materials development.