



TRICE RESEARCH GROUP FOR HYPERSONIC MATERIALS

HOT STRUCTURE

- ADDITIVE MANUFACTURING OF C/C COMPOSITES
- DIRECT INK WRITE OF C_f /SiC CERAMIC MATRIX COMPOSITES
- ENERGY ABSORBING CERAMICS FOR ROTATING DETONATION ENGINE CERAM
- DIGITAL LIGHT PROJECTION AM OF CERAMICS
- JOINING OF DISSIMILAR CERAMICS
- MORPHING HOT STRUCTURE

WINDOWS

- RF (POROUS Si_3N_4 VIA SLIP CASTING)
- RF DIRECT INK WRITE OF Si_3N_4
- IR (PLATELET Al_2O_3 AND Y_2O_3/MgO)

THERMAL PROTECTION SYSTEMS

- HIGH EMISSIVITY AND OXIDATION RESISTANT COATINGS FOR C/C COMPOSITES
- SILICIDE COATINGS FOR Nb ALLOYS
- CHARACTERIZATION OF SPACE-SHUTTLE TILES PRODUCED VIA AUTOMATION

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Expertise:

Ceramic Materials

ZrB_2 , Si_3N_4 , Al_2O_3 , B_4C , SiC , ZrO_2 , CMCs, etc

Ceramic Processing

sintering, rheology, additive manufacturing, extrusion manufacturing, digital light projection, direct ink write (robocasting), co-extrusion, plasma spray, suspension plasma spray, injection molding

Testing

35 years mechanical testing at elevated temps, thermal analysis, failure/stress analysis, ablation testing, emittance testing

Current Research in Hypersonics:

1. AFOSR: Design of Energy Absorbing and Tough Ceramics for Rotation Detonation Engines
2. AFOSR: Embodied Sentient Mechanomorphing for Agile Control in High-speed (e-SMACHs) Vehicles (with Prof. Andres Arrieta)
3. ONR: Sustained Thermomechanical Response of High-Frequency Propulsion Materials (with Prof. Georgios Koutsakis/UNM)
4. NSTXL/NAVSEA: Incorporating BNNTs into Silicon Nitride (with Prof. Jeffrey Youngblood)
5. Silicon Nitride Dual Phase RF Windows for Low Dielectric Constant: NDSE
6. AI/ML of Direct Ink Written CMCs, SMART
7. Canopy Aerospace: AFWERX Phase II STTR Proposal – Autonomous Robotic Coating for TPS (ARCT)
8. AFRL Midwest Hub: Morphing Surfaces - PI Andres Arrieta
9. Direct Ink Write of UHTC CMCs – PMRI
10. Prof. Trice has developed and taught a “Ceramics for Hypersonic Applications” at Purdue and short courses at various venues

