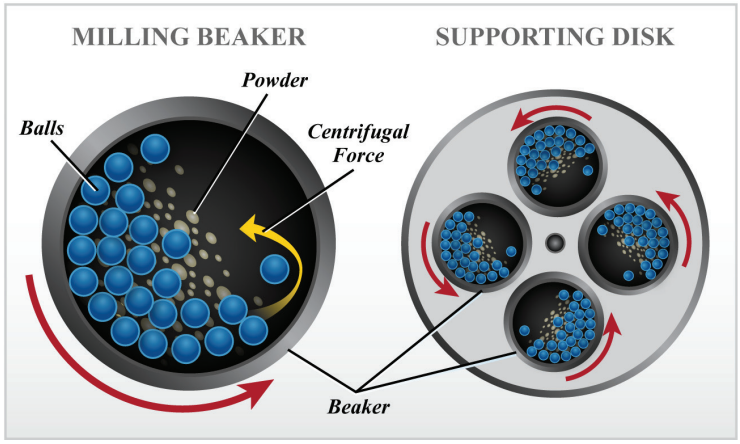
Synthesis Lab

Next-gen 2D materials and ultra-thin functional films specifically designed to counter high-powered radio frequency (RF), high-energy laser (HEL), and high-altitude electromagnetic pulse (HEMP) threats where traditional shielding fails

The Synthesis Lab addresses the growing vulnerability of modern electronics and defense systems through multiferroic nanoparticles for electromagnetic interference (EMI) suppression, stacked thin films for spintronic RF detection, 2D materials for HEMP protection, and material-level countermeasures.

Primary threats targeted include HEMP events, directed energy weapons (DEW), persistent EMI, and electronic warfare (EW).



Leveraging high-energy ball milling to engineer nanostructured materials for next-generation EMI shielding applications.

Our Capabilities

1. Advanced thin films and nanoparticles material development that transform material properties to provide the robustness required for DoD applications.

2. Novel synthesis processes and characterization methods which includes:

    - Separating wet chemistry, powered handling, and vacuum systems
    - Safety and compliance setup

Post-processing ball-milled powders via thermal annealing to optimize crystallinity, phase stability, and EMI shielding performance.

Key Features

- Multiferroic nanoparticles for EMI suppression
- Stacked thin films for spintronic RF detection
- 2D materials for HEMP protectoin
- Material-level countermeasures

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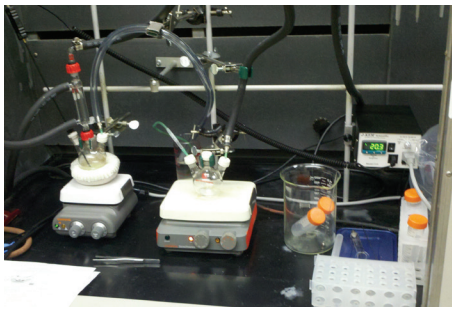
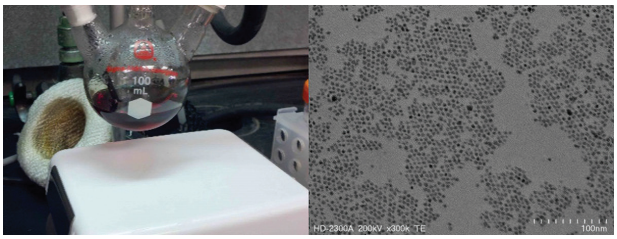
Processes

- Integrate 2D materials growth
- PVD-based thin film engineering
- Chemical synthesis of multiferroic nanoparticles
- High-energy ball milling (HEBM) for custom powder and composite development

These processes are designed to support counter-HEMP, RF, and HEL applications. Synthesis will enable rapid prototyping of smart, scalable, and multifunctional materials for electromagnetic (EM) shielding, sensing, and survivability in contested environments.



Scalable wet chemistry routes to functional nanomaterials tailored for EM survivability and shielding.



Wet chemical synthesis of nanoparticle and 2D materials engineered for electromagnetic survivability in extreme environments.

Next Steps

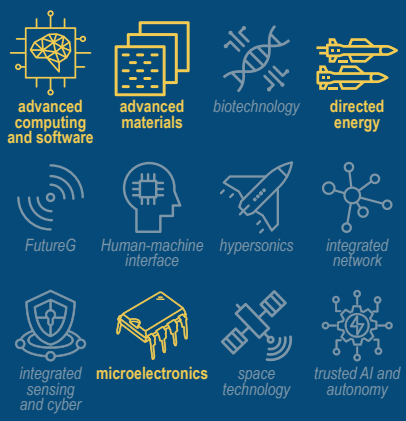
Based on current frequency-dependent performance of our nanoparticles, we've determined the needed chemical dopants and additives to optimize particle shape, size, and surface properties.

Other laboratory advancements include:

- Performing pre-install readiness checks to ensure the site utilities (electrical, gas, chiller, and exhaust) can facilitate new equipment
- Working with collaborators to develop our recipes for thin films using their Devices for Emergent Electronics and Photonics (DEEP) and Materials Characterization Facility (MCF) laboratories
- Finalizing quotations for hoods, benches, and storage cabinets (solvents, acids, and bases)
- Focusing on more simulation and modeling projects between COMSOL, JARVIS, and DFT to inform expected structural and electromagnetic behavior before fabrication

RIVERSIDE RESEARCH

Critical Tech Areas



DoD Priorities

1. Southwest Border Activities
2. Combating Transnational Criminal Organizations in the Western Hemisphere
3. Audit
4. Nuclear Modernization (including NC3)
5. Collaborative Combat Aircraft (CCAs)
6. Virginia-class Submarines
7. Executable Surface Ships
8. Homeland Missile Defense
9. One-Way Attack/Autonomous Systems
10. Counter-small UAS Initiatives
11. Priority Critical Cybersecurity
12. Munitions
13. Core Readiness, including full DRT funding
14. Munitions and Energetics Organic Industrial Bases
15. Executable INDOPACOM MILCON
16. Combatant Command support agency funding for INDOPACOM, NORTHCOM, SPACECOM, STRATCOM, CYBERCOM, and TRANSCOM
17. Medical Private-Sector Care