Contract No:

This document was prepared in conjunction with work accomplished under Contract No. 89303321CEM000080 with the U.S. Department of Energy (DOE) Office of Environmental Management (EM).

Disclaimer:

Savannah River National Laboratory

We put science to work.™

SRNL-STI-2022-00083

Creating Manufacturing Solutions for EM, NNSA, and Energy Security – *Energy & Environment*

Manufacturing Competency Workshop

February 22-23, 2022

U.S. DEPARTMENT OF ENERGY

Managed and operated by Battelle Savannah River Alliance, LLC for the U. S. Department of Energy.

BSRA Battelle Savannah River Alliance, LLC

SRNL Environmental Programs – Focus Areas

- Radioactive Tank Waste Stabilization, Treatment and Disposal
  - Waste Retrieval & Processing
  - Waste Treatment
  - Waste Form Development and Production
  - Tank Closure
- Spent Nuclear Fuel and Nuclear Materials Management and Disposition
  - Nuclear Materials Disposition & Recovery
  - Waste Treatment & Optimization
- TRU and Mixed Low-Level Waste (MLLW) Disposition
- Soil and Groundwater Remediation
  - Matching innovative strategies/ technologies with site-specific conditions
  - Leveraging concepts that require less energy for the DOE complex
- Excess Facilities Deactivation and Decommissioning (D&D)

Ion Exchange for Waste Pretreatment

Nuclear Materials Challenges

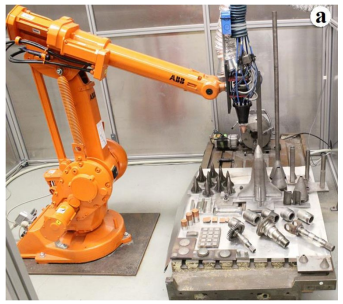
- >40,000 TBD Items (NMI Report)
- Long-Term Disposition need for Research Reactors
- Isotope Recovery from Spent Nuclear Fuel (SNF)
- Advanced Reactor Backend
- German Graphite Fuel Disposition
- Non-Aluminum SNF Disposition
- MK-18 Isotope Recovery (Synergy with GS)

Energy Systems - Exploring energy materials with a variety of platforms and systems

- SRNL is involved in work related to the most important challenges that must be addressed to make the hydrogen economy a reality
  - Safe, clean production of hydrogen
  - Light-weight, cost-effective storage of hydrogen
- Efficient energy conversion via batteries, thermal storage, fuel-cells, and catalysis
- Innovations in advanced manufacturing, material science, and scientific computing to advance renewable energy technologies and energy efficiencies.

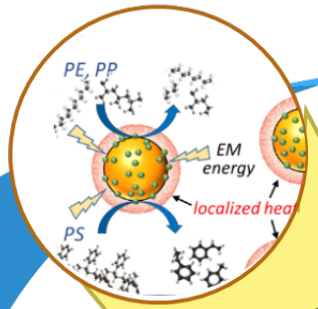
Hydrogen and natural gas storage, based on tritium technologies

Directed Energy Deposition (DED) Additive Manufacturing (AM)



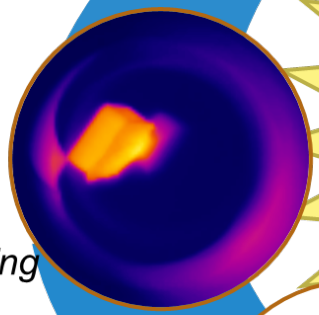
Leveraging Advanced Manufacturing Ideas for Energy Efficiency

AMO Seedling
- *Directed Electromagnetic Thermocatalysis for Selective Conversion of Waste Plastic to High Value Intermediates*

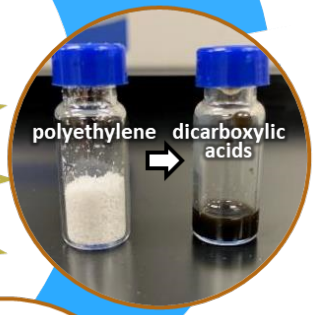


CREATE
Center for Research in Electromagnetic and Thermal Engineering

VTO
- *Soft Smart Tools Using Additive Manufacturing*

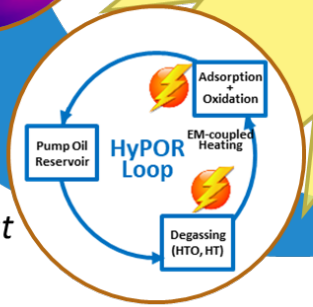


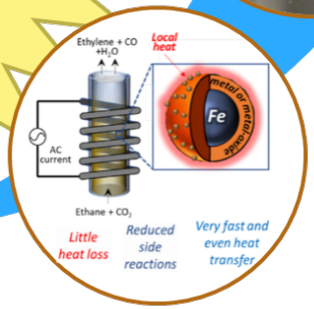
Thermal Process Intensification at SRNL



DARPA ReSource
- *EM-Enhanced Thermocatalytic Depolymerization of Mixed Plastic*

ARPA-E
- *EM-Enhanced HyPOR Loop For Fast Fusion Fuel Cycles*





EERE AMO
- *Thermocatalytic Ethylene Production Using Targeted RF Induction Heating*

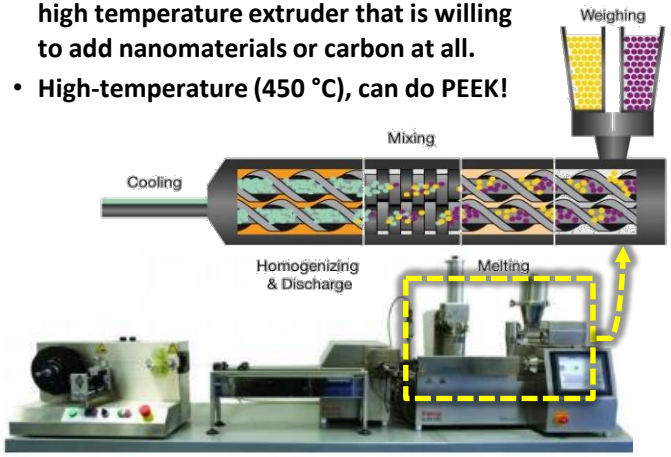
Additive Manufacturing at SRNL

Challenges for Additive Manufacturing

- Increase material performance
- Tailor new materials formulated for additive manufacturing
- Develop new processing techniques to increase performance and throughput.

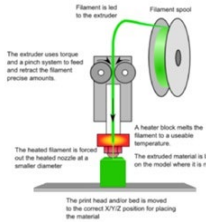
R&D Capability Needs

- **Very few researchers have access to a high temperature extruder that is willing to add nanomaterials or carbon at all.**
- **High-temperature (450 °C), can do PEEK!**

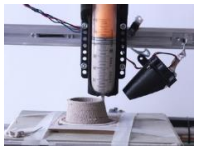


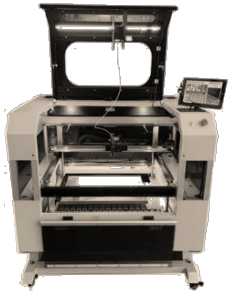
Thermo Scientific™ Process 11 Twin-Screw Extruder

SRNL Current Capabilities

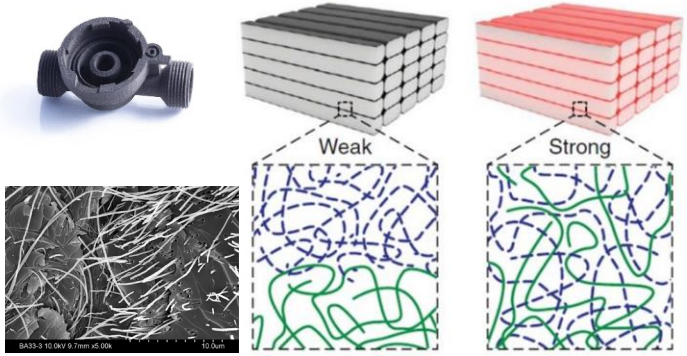


Filament





Approach



- Explore material properties that can't be produced in bulk
- EM-coupled heating to improve material properties and printing throughput (e.g. improve heating/cooling of filament)
- Catalyst coated filaments for high reactant flow throughput fixed and rotating fixed beds; Hierarchically Porous Catalysts
- NNSA applications – ongoing projects
- High temperature, high strength for aerospace and military