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ARL Center for Advanced Polymer Processing (ACAPP)

S&T Campaign: Materials Research
Unique ARL Facilities (APG)

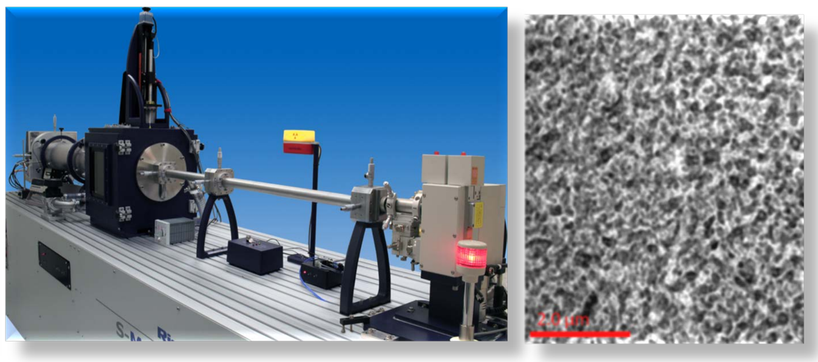
Joseph L. Lenhart, (410) 306-1940
joseph.l.lenhart.civ@mail.mil

ACAPP Mission: Safe, reproducible, and novel processing approaches for hierarchical polymers, targeting improvements in mechanical, electrical, optical, transport, and reactivity properties, serving the full spectrum of ARL mission critical research areas.

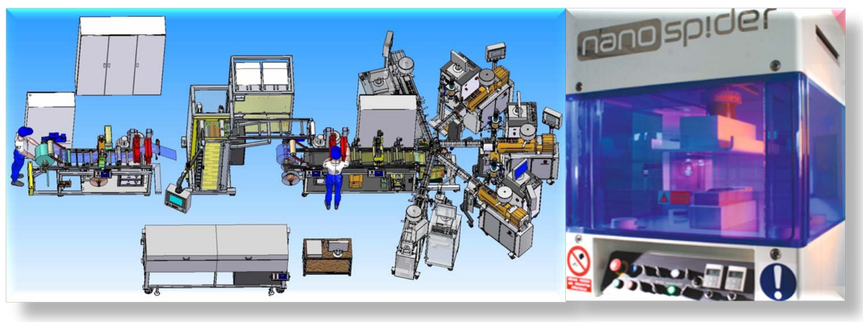
1) ***Laboratory engineering controls*** for safe / reproducible processing in controlled environments

2) ***Advanced mixing equipment*** for control of polymer and polymer nano-composite structure / dispersion

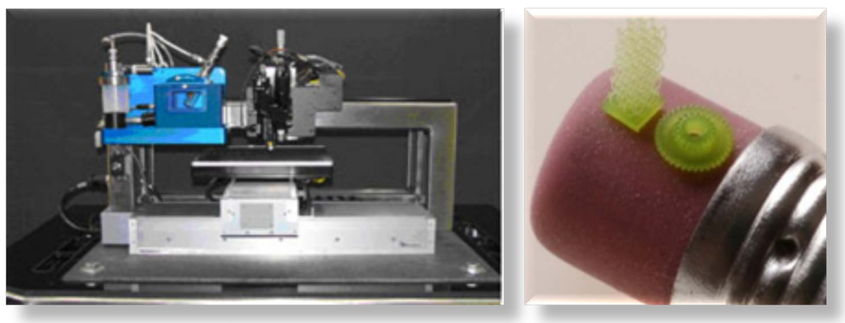
3) ***Material characterization*** to establish processing – structure – property relationships



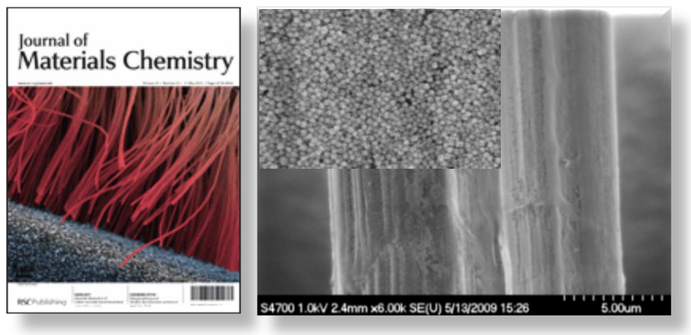
4) ***Post extrusion processing*** of fibers, films, bulk specimens with lab to pilot scale processing equipment



5) ***Micro-fabrication of polymers*** and nano-composites with 2D and 3D structures for multi-functionality

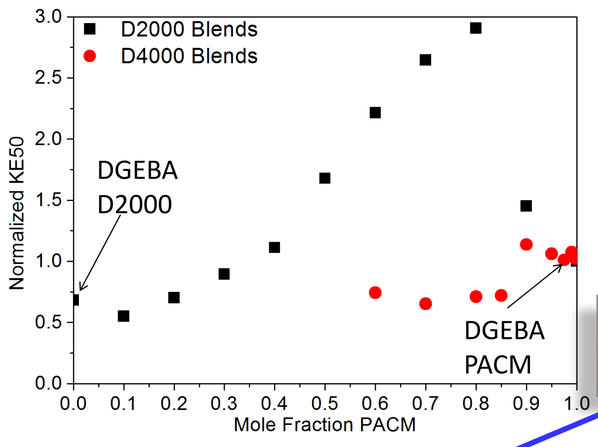


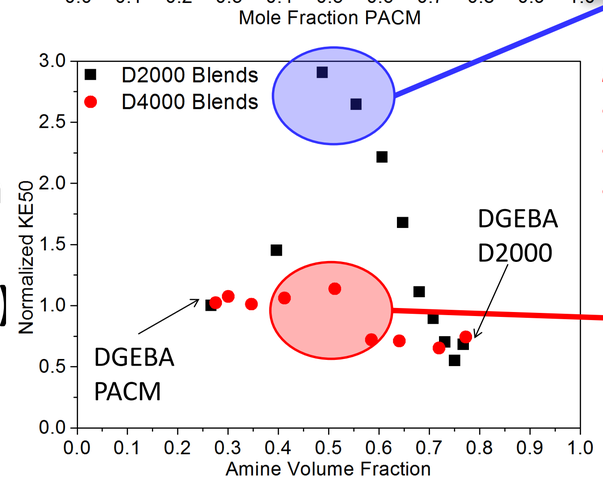
5) ***Macro-fabrication*** of hybrid nano-composite and continuous fiber reinforced polymer composites

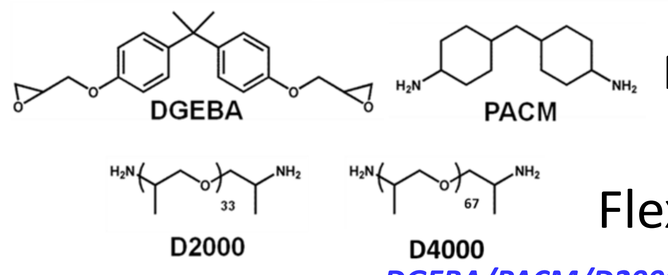


Unique ARL Facilities

- Polymer processing facilities to bridge lab and pilot-scale with six co-located investment areas
- Safe handling of large quantities of dry micro- and nano-particulate powders
- High shear melt and solid-state compounding to design resins, inks, composites that feed fiber, film, micro-, and macro-fabrication facilities
- Melt and gel spinning of polymer fibers
- Melt, gel, and solid state processing of polymer film
- Compounding, film, fiber, and composite formation in clean-room environment with particulate (100,000), temperature (70 °C), and humidity control (to 25% RH)





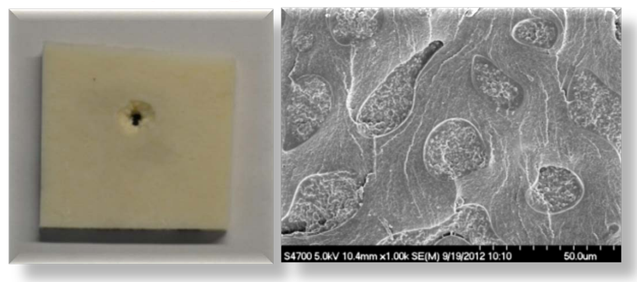


Rigid

Flexible

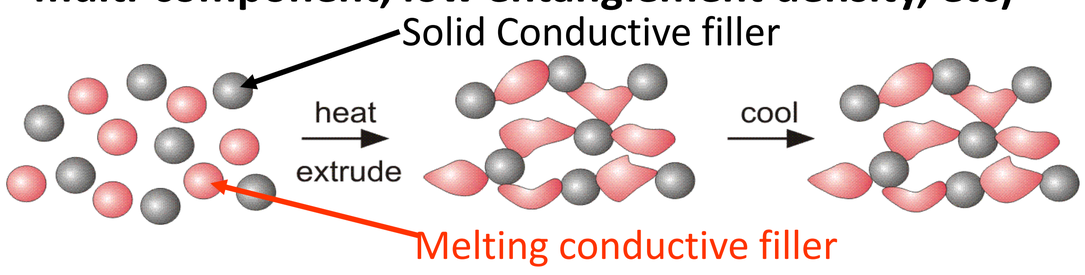
DGEBA/PACM/D2000 Blends:
- Optically transparent
- Dynamically heterogeneous (two glass transitions)
- 1-10 nm scale morphology

DGEBA/PACM/D4000 Blends:
- Opaque
- Macro-phase separated
- µm + scale morphology



Complementary Expertise Sought

- In-situ diagnostics during polymer processing
- Process modeling to predict chemical and structural evolution during processing
- Novel polymeric feed-stocks (chemistries, co-polymers, multi-component, low entanglement density, etc)



Unique ARL Developed Materials

- ***Mechanics:*** Improved impact resistance over military operational temperature ranges (-55 to 75 °C) with blends of rigid and flexible polymers
- ***Electronics:*** Melt processable conductive composites with > 1000 S/cm electrical conductivity

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