



U.S. ARMY  
**RDECOM**

# Atmospheric Plasma Modification of Materials

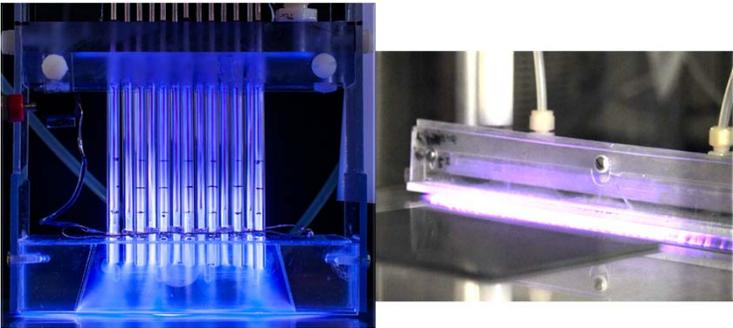


## S&T Campaign: Materials Research High Strain Rate and Ballistic Materials

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### Research Objective

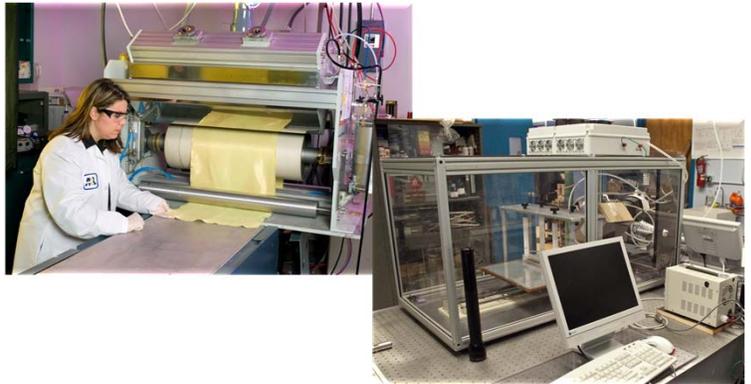
- Utilize novel atmospheric plasma processing methods to enhance performance of ceramic, metallic, polymeric, and composite materials systems.
- Make strides towards understanding the role of atmospheric plasma exposure in altering the near-surface and interfacial chemistry of materials.



Various electrode designs for atmospheric plasma processing including plasma jet (left) and linear DBD (right).

### ARL Facilities and Capabilities Available to Support Collaborative Research

- Cylindrical RF Dielectric Barrier Discharge (DBD) system for processing fabrics and polymeric films.
- Roll-to-roll processing capability with fully automated wind/unwind system.
- Microsecond-pulsed DBD planar system for processing ceramics, polymers, and composites.
- Pulsed DBD afterglow system, allowing the treatment of conductive materials.
- Plasma-enhanced chemical vapor deposition (PECVD)
- Optical emission spectroscopy (OES) capabilities
- High-Speed photography for plasma characterization



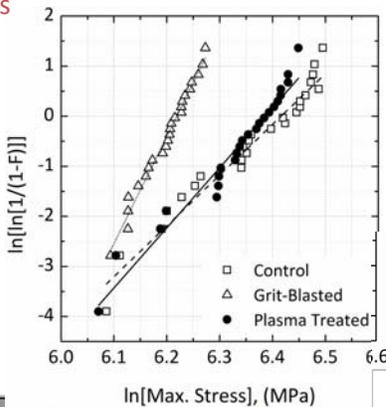
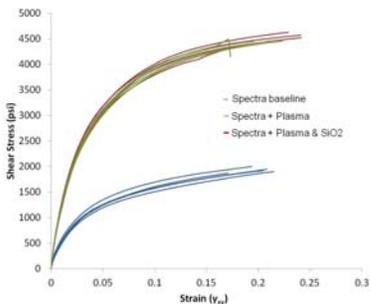
### Challenges

- Glow-to arc transitions
- Reproducibility of experimental conditions
- Post-treatment recovery and contamination
- Complex chemical interactions and metastable species

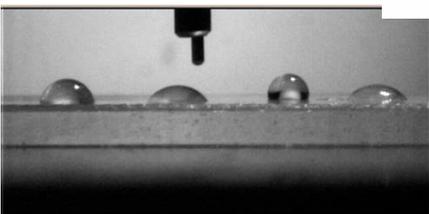
### Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Power supply design for ultra-fast pulsed (nanosecond) plasma reactors.
- Electrode design for mitigation of microdischarges
- Modeling of atmospheric plasma reactions
- Atmospheric residual gas analysis (aRGA)
- Process/property relationship of PECVD films

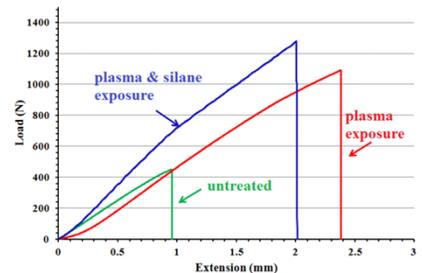
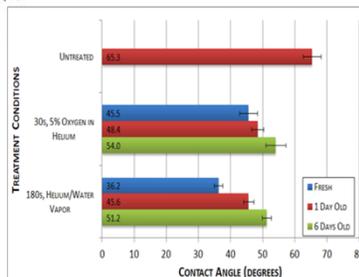
#### Organic Fiber Composites



#### Ceramics



Patterning



#### Thermoplastics