Atmospheric Plasma Processing of Materials

ARL open campus

S&T Campaign: Materials Research
Tier 2: High Strain Rate & Ballistic Materials

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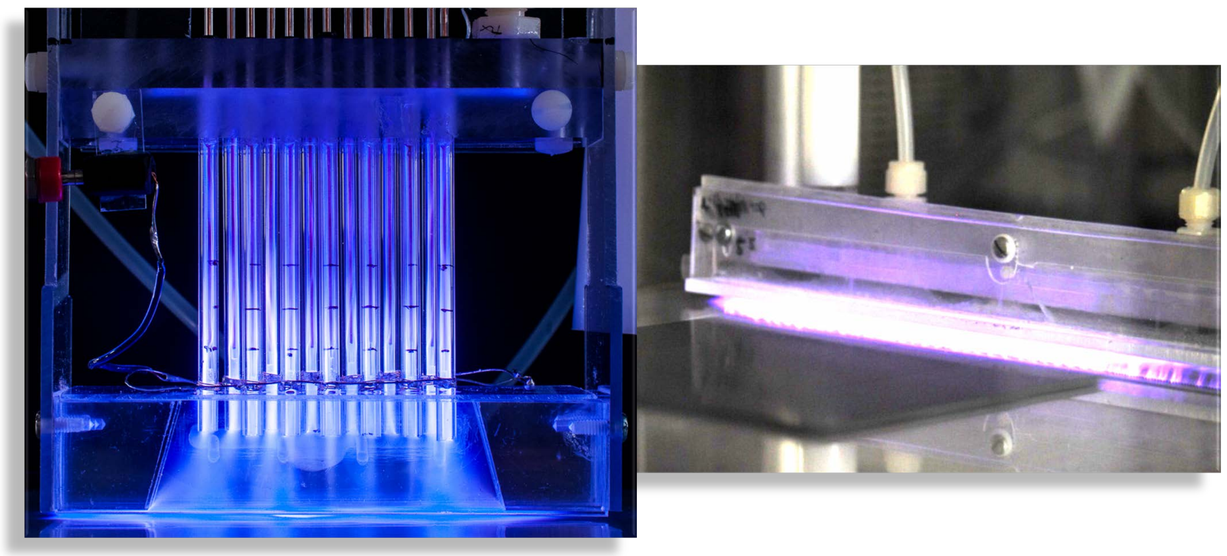
Research Objective

- **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.**



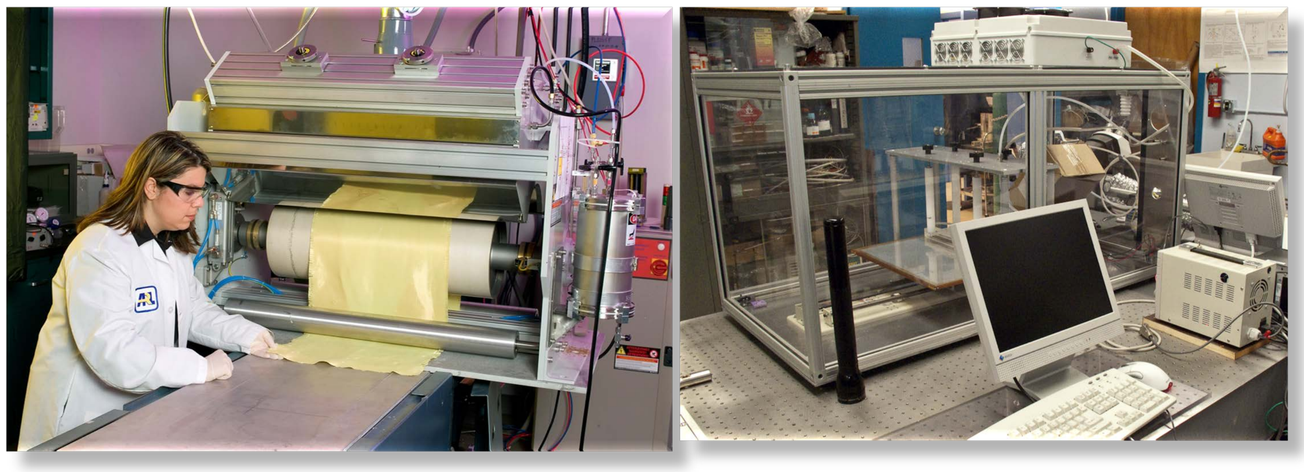
Various electrode designs for atmospheric plasma processing including plasma jet (left) and linear DBD (right).

Challenges

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

ARL Facilities and Capabilities Available to Support Collaborative Research

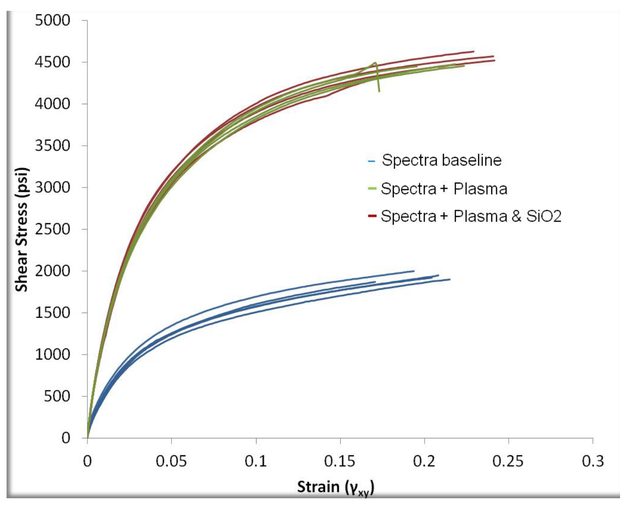
- **Cylindrical RF Dielectric Barrier Discharge (DBD) system for processing fabrics and polymeric films.**
- **Roll-to-roll processing capability with fully automated wind/unwind system.**
- **Microsecond-pulsed DBD planar system for processing ceramics, polymers, and composites.**
- **Pulsed DBD afterglow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

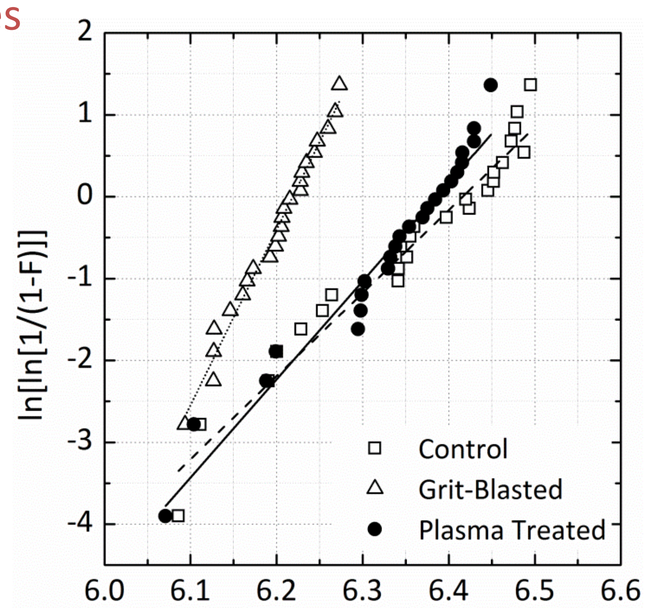


Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

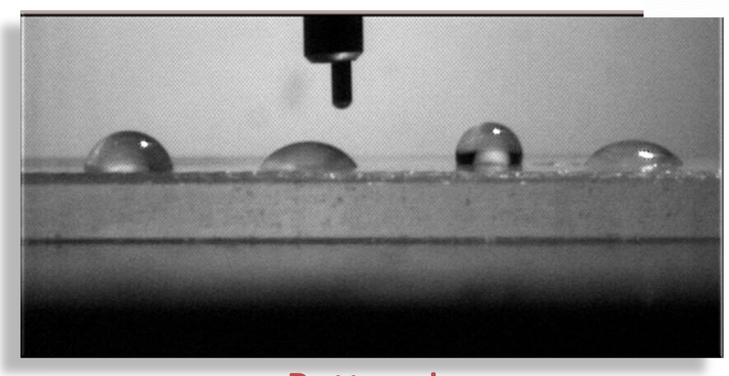
- **Power supply design for ultra-fast pulsed (nanosecond) plasma reactors.**
- **Electrode design for mitigation of microdischarges**
- **Modeling of atmospheric plasma reactions**
- **Atmospheric residual gas analysis (aRGA)**
- **Process/property relationship of PECVD films**

Organic Fiber Composites

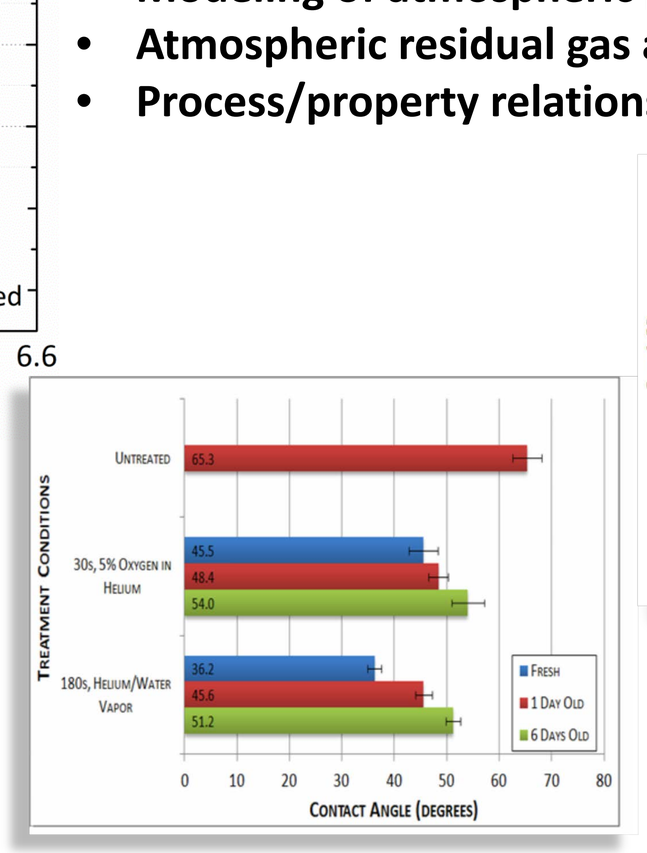


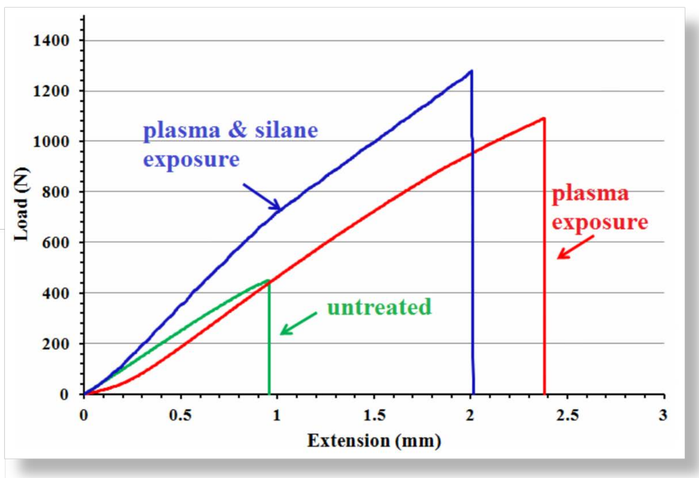


Ceramics



Patterning





Thermoplastics