



U.S. ARMY
RDECOM

Damage Tolerant Adhesives

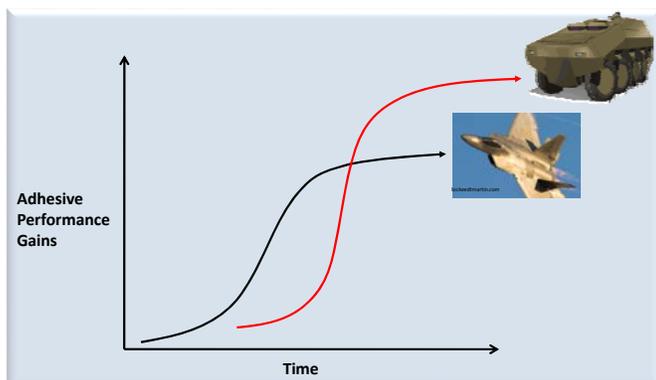


S&T Campaign: Materials Research Biological and Bio-inspired

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Research Objective

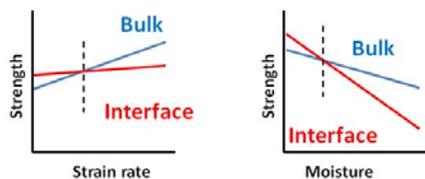
- Drive state-of-the-art adhesion performance past historical benchmarks established by aerospace.
- Describe how this research pushes the boundaries of the state of the art in the research field



Aerospace adhesive technology has matured, but innovations may not displace accepted formulations. Ground vehicles tolerate component risk more readily and can probe new technologies.

Challenges

- Army development timelines are pressured by emerging threats from the battle field
- > 400 commercial adhesive formulators
- Engineering data difficult to obtain outside of aerospace applications
- Army demands performance under unique high loading rate and other extreme environments (temperature & humidity extremes)



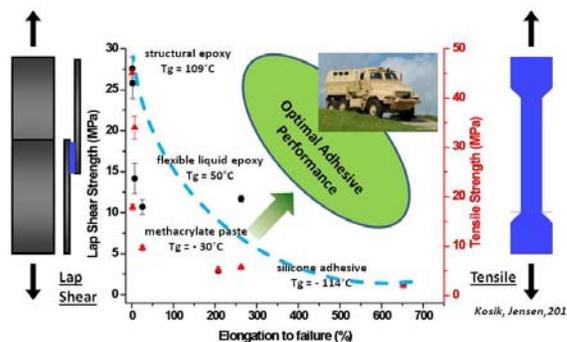
Plots of generic adhesive performance under variable strain rate and humidity conditions. Quasi-static performance may not reflect high rate characteristics; the adhesive bond interface is more susceptible to degradation by adventitious moisture than the bulk of the adhesive.

KEY CHALLENGE:

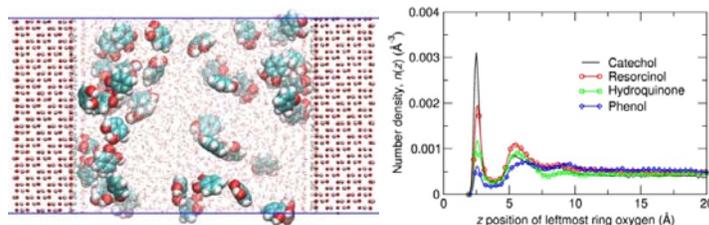
Can materials informatics and new approaches to adhesive design be coupled to tune performance across a broad range of environments?

ARL Facilities and Capabilities Available to Support Collaborative Research

- Full suite of mechanical testing capabilities, focused on tensile and shear failure modes
- Computational modeling of adhesive interfacial interactions, polymer network interactions
- Expansive characterization capabilities including XPS, SEM, TEM, FTIR microscopy, RAMAN microscopy, AFM
- MSAT database with pedigreed dataset, acquisition protocols



Current adhesives encompass a wide range of performance tradeoffs but are not optimized for Army applications.



Modeling catechol & related compound interactions with an alumina substrate in an aqueous environment.

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- ARL has established accepted protocols for adhesives testing, welcomes novel adhesives for database inclusion (Jensen et al., ARL-SR-288, June 2014).
- Novel techniques for characterizing interfaces or surfaces are welcomed.