

Understanding onset of damage in multifunctional composite

1. **Research Title:** Understanding onset of damage in multifunctional composite

2. **Individual Sponsor:**

Dr. Dhriti Nepal, AFRL/RXCC
Structural Materials Division
Materials and Manufacturing Directorate Air Force Research Laboratory
AFRL/RXCC, Bldg 655 Rm 019
Wright-Patterson AFB, OH 45433-7750

3. **Academic Area/Field and Education Level**

Materials Science and Engineering, Chemical Engineering, Chemistry, or Physics (MS or PhD level)

4. **Objectives:** Understanding onset of damage in multifunctional composite, nanoscale strain mapping, underlying processing-structure-property relationship by combining both experimental and computational approaches.

5. **Description:** Efficient materials design and development of tools for its damage prediction are crucial for multifunctional composites. Major failures in composites are associated with the huge difference in thermal expansion coefficient between the filler and the polymer matrix, the issue with the interface / interphase, and poor reinforcement. Overcoming these challenges requires careful design and a multidisciplinary approach combining synthesis, processing, characterization (across scales), and multi-scale modeling. We are interested in understanding the failure mode at the nano to the higher scale, and the underlying processing-structure-property relationship. Key interests include elucidating the fundamental principles of the underlying fracture mechanism based on chemistry and shape / size / distribution of the nanofillers; investigating corresponding electrical and optical properties; establishing techniques to predict failure using molecular, and mesoscale mechanics modeling. Techniques include bulk and surface spectroscopy, high-resolution X-ray micro-computed tomography, nanoscale chemical / physical / mechanical mapping, atomic force microscopy, electron microscopy, in-situ testing, and multi-scale modeling.

6. **Research Classification/Restrictions:** Unrestricted

7. **Eligible Research Institutions:** Indicate to what organizations this topic should be provided



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