Dr. W. Joshua Kennedy Talk Title /Abstract

Title: EMI shielding of MXene films and composites in aerospace applications

Composite aerostructures are lighter than their metallic predecessors, but their electrical conductivity is many orders of magnitude lower. This makes composite structures much more susceptible to lighting strike damage and unwanted electromagnetic interference (EMI) with on-board electrical systems. Various conductive fillers have been added to polymers to impart conductivity to the composite material, including metallic and carbon micro- and nano-structures. Recently, a new class of ceramic-derived, two-dimensional metal carbides known as MXenes has shown great promise for EMI shielding, with shielding effectiveness (SE) per unit weight far better than state-of-the-art materials. However, little is known about the fundamental mechanisms that make these materials so effective. We have studied the optical and electronic properties of one species of MXene, namely $Ti_3C_2T_x$ (where T_x is a functional surface termination), and we have demonstrated that optical and vibrational resonances can be used to assess changes in the electronic character of these materials as a function of layer thickness and surface chemistry. These changes have a direct impact on the EMI shielding of thin, free-standing films of MXenes. Our work provides insights into chemical and processing considerations in the development of the next generation of EMI-shielded composite aerostructures.

Dr. W. Joshua Kennedy received his Ph.D. in physics from the University of Utah where he studied the optoelectronic properties of single-walled carbon nanotubes with Dr. Valy Vardeny. After postdoctoral positions at the University of Texas at Dallas and at NASA Johnson Space Center, Dr. Kennedy joined the Polymer Matrix Composites Materials and Processes Research Team at the Air Force Research Laboratory (AFRL), Wright-Patterson Air Force Base, OH. He now serves as the Assistant Chief Scientist of the Materials and Manufacturing Directorate at AFRL, where his group continues to study multifunctional nancomposite materials for Air Force applications.