Time & Location: March 27, 2014 at 8:00 AM in EGN1 288
Title: Nondestructive Analysis of Advanced Aerospace Materials via Spectroscopy and Synchrotron Radiation

Advanced aerospace materials require extensive testing and characterization to anticipate and ensure their integrity under hostile environments. Characterization methods utilizing synchrotron X-Ray diffraction and spectroscopy can decrease the time required to determine an emerging material's readiness for application through intrinsic information on the material response and failure mechanisms. In this study, thermal barrier coating samples applicable to turbine blades of jet engines were studied using Raman and Photoluminescence spectroscopy as well as Synchrotron X-ray diffraction while Kevlar-based fiber composites applicable to ballistic resistant armor were studied using Raman spectroscopy to investigate the mechanical state and corresponding damage and failure mechanisms.

Piezospectroscopic studies on the stress state of the thermally grown oxide (TGO) within the thermal barrier coatings, on a hollow cylindrical specimen, provided results that indicate variations within the TGO. Comparison of measured photo-luminescence spectra of the specimen before and after long duration thermal aging showcases the development of the system and the initiation of micro-damage. Raman spectroscopy performed on Kevlar ballistic composites with nanoscale additives, presented insight into the additives' role in load transfer and damage propagation through a comparison of the shift in optical spectra to that of the pristine fibers.

The results presented herein utilize changes in the measured emission from these non-destructive testing techniques to link the phenomena with material response. Techniques to optimize imaging and spectral collection are addressed as well. The findings will advance the use of the techniques in the development of aerospace materials, providing a more complete understanding of land and aircraft turbine, and fiber composite response to complex loading.

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Approved for distribution by Seetha Raghavan, Committee Chair, on March 7, 2014.

The public is welcome to attend.