

UTILIZING THE ELECTRICAL PROPERTIES OF NON-OXIDE CERAMIC COMPOSITES TO DIAGNOSE DAMAGE DEVELOPMENT, TEST CONDITIONS AND DEFECTS

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State-of-the-art ceramic matrix composite contain electrically semi-conducting or conducting constituents such as SiC, C and Si. The electrical resistivity of these types of composites or composite structures depend on the fractional content, interconnectivity of conducting phases within the lowest resistivity constituent and anisotropic features such as fiber architecture. If these characteristics and features are understood, electrical resistance can be used as an inspection (quality control) technique, a method to monitor damage and/or a method to monitor test conditions such as temperature. In this presentation, several examples will be presented as to these ends. First, it will be shown how electrical potential drop techniques can be used to detect flaws such as delamination in as-produced Si-containing composites. Second, it will be demonstrated how understanding the electrical properties of individual plies in laminate Si-containing CMCs can be used to monitor crack growth at room and elevated temperatures. Finally, the usefulness of monitoring electrical resistance will be shown at elevated temperature for burner rig tests (figure 1) on SiC-based faceplate/foam structures under burner rig conditions approaching hypersonic velocities and extreme temperatures. The results of this work imply the potential to utilize the electrical properties of these types of composites and structures in design of composites.

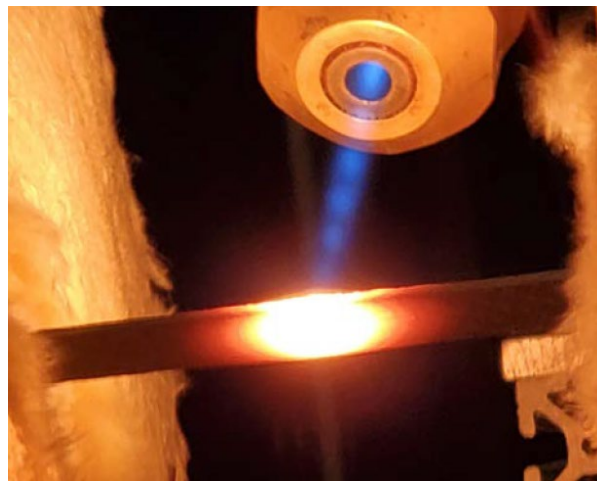


Figure 1 – HVOF burner rig testing of SiC/SiC composite showing front side temperature, back side temperature and electrical resistance measurement for a series of temperature cycles.