Particulate composites are widely used in many aerospace applications such as protective coatings, adhesives, or structural members of a body and their mechanical properties and behavior have gained increasing significance. The addition of modifiers such as alumina generally leads to improved mechanical properties. This addition also enables the non-invasive study of the load transfer between the particle and the matrix. Understanding of the load transfer between the particulate and the matrix material is the first step to understanding the composite as a whole and its behavior and mechanical properties. Piezospectroscopy is a phenomenon used here to study load transfer and is defined as the linear relationship between the photoluminescent peak position and stress in the alumina.

In this work, samples with an isolated alumina particle embedded in an epoxy matrix were created to replicate the ideal assumptions for many particulate mechanics models. In separate experiments, both photo stimulated luminescent spectroscopy (PSLS) and synchrotron radiation were used to collect the spectral emission and diffraction rings, respectively, from the mechanically loaded samples. The PSLs data and XRD data are shown to be in qualitative agreement of particle size effects on load transfer with supporting comparisons from theoretical methods based on the Eshelby model. Results from this work provide experimental insight into the load transfer properties of particulate composites and can serve to experimentally validate the theoretical load transfer models that currently exist.

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The public is welcome to attend.