Innegra™ S – Vibration Damping

Vibration in structures is generally undesirable, and many techniques are employed to reduce it. Passive damping of a structure relies on the inherent ability of certain types of materials to absorb mechanical energy and dissipate it through means such as deformation or transformation to heat. Suitable materials for use in passive vibration damping are those with a viscoelastic nature, such as polymers, especially thermoplastic polymers. Vibration damping is sensitive to material anisotropy, so vibration propagation in a composite will be dependent on material selection and structural design. In composites built around a core, the materials properties and thickness of the core are key factors, in addition to the fiber-reinforced laminate material selection, stacking sequence, and fiber orientation. Innegra™ S, as a highly crystalline thermoplastic fiber, presents a novel way to incorporate damping into a material structure in a tunable manner and has inherently superior vibration damping properties, compared to carbon fiber.

Vibration Damping Testing

Composite panels were pressed from Mitsubishi Newport NCT301-1-MR60H G150 unidirectional carbon/epoxy and NCT301-E300 InnegraS/epoxy prepregs. Samples of 100% Innegra fiber, 100% carbon fiber, and ~50/50 Innegra/Carbon fiber were prepared, with composite laminate schedules established to achieve approximately the same net laminate thickness after pressing. All plies were aligned with the unidirectional fiber axis, and coupons were cut with the coupon axis aligned with the fiber 0° direction.

Vibration damping measurements were conducted by means of a continuous excitation system, using an impedance head to actuate the samples and obtain the output acceleration signals. The vibration damping ratio was calculated using the half-power bandwidth method.

Results

Addition of Innegra™ S fiber into a carbon fiber composite shifts the resonant frequency lower and increases the damping properties of the composite.