Additive manufacturing (AM) material assurance has relied upon traditional test coupons and testing methods which work well for wrought materials, but fail to address the unique and not as well-known characteristics of AM parts. Sandia engineers have been working on a new standardized, integrated test coupon specifically designed for AM that allows for non-destructive testing of material properties, allowing for repeated testing through a series of environments in order to characterize part reliability.

This new multi-axis linear flexural cantilever test coupon is designed as one continuous part with no assembly required and can be printed using a variety of materials and AM methods. The linear flexure design enables simplified vibration (modal) analysis of structure-property information, and the multi-axis aspect of the design allows for determination of inhomogeneity in printed materials. Using various sensors, a non-destructive modal analysis measures time-dependent evolution of position following the convection of an impulse to the cantilever system, one axis at a time. Analysis of this data can be used to determine structural-property information, such as Young's modulus, damping coefficient, stiffness, shear modulus, and deviations from normal response pointing to microstructural defects. Due to the non-destructive nature of this testing, repeat studies of the same part can be carried out in varying conditions. This allows for an analysis of the impact on the structural-properties of the specimen before, during, and after exposure to varying environments. Non-destructive modal testing techniques also lead to more accurate data.

Sandia’s AM test coupon offers testing of a number of different mechanical properties that can lead to a better understanding of the unique microstructures associated with additive manufactured parts.

**TECHNICAL BENEFITS**

- Test artifact can be printed using a variety of materials (metals, ceramics, plastics) and different AM methods
- Allows repeated testing of a material in various environments
- Offers testing of a large set of mechanical properties
- Modal testing technique results in extreme testing accuracy