

## High Sensitive Graphene-Based Strain Sensors for SHM of Composite Laminates

**Authors :** A. Rinaldi, A. Proietti, C. Aquarelli, F. Marra, A. Tamburrano, M. Ciminello, M. S. Sarto

**Abstract :** A new type of high sensitive piezoresistive sensors based on graphene was developed within the SARISTU project for application on Structural Health Monitoring (SHM). The new sensor consists of a graphene-based film, obtained through the spray deposition of a colloidal suspension of Multi-Layer Graphene (MLGs) nano platelets over a substrate. MLGs are produced by liquid exfoliation of thermally expanded Graphite Intercalation Compound. An array of 8 sensors is produced by spray deposition over an aeronautical CFRC plate of dimensions 550 mm (length) × 550 mm (width) × 3 mm (thickness). Electromechanical tests were performed in order to assess the sensitivity of the new piezoresistive sensors, which are characterized by an isotropic response. In the quasi-static characterizations, the CFRC plate was clamped on one side and loaded on the opposite one. The local strain map of the plate was then obtained from displacement measurements and numerical analysis. The dynamic tests were performed lying the plate over an anti-vibration table and actuating a piezoelectric element located in the middle of the sensing array. The obtained experimental results demonstrated that the sensors possess a good repeatability and a high constant gauge factor (~200) in the applied strain range 0.001%-0.02%. Moreover, they can follow dynamics up to 400 kHz and for this reason they are good candidates for Lamb-wave analysis.

**Keywords :** graphene, strain sensor, spray deposition, lamb-wave analysis

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