Development of piezoelectric strain sensors embedded within dissimilar material joints

A Deligianni, J M Hale, G Kotsikos

School of Mechanical & Systems Engineering, University of Newcastle upon Tyne, Newcastle upon Tyne, NE1 7RU, UK

Piezoelectric thick film sensors have been developed to be embedded into the adhesive layer of a lap joint and used as strain sensors. A novel approach of obtaining quantitative, interfacial strength information by using piezoelectric liquid adhesive is proposed in this work. This application allows the direct measurement of the variation of the interfacial strength in a joint along the overlap area, aiming at the optimisation of the adhesive bonded joint design of the aeronautic industry. In the present work, preliminary results showed the performance of a single sensor within the joint assisting in the characterization of the sensor [1]. The piezoelectric adhesive was applied between the two adherents of the joint, using the two metal substrates as the electrodes of the sensor. Based on previous work of the author's group, this piezoelectric adhesive was made of a fine piezoelectric ceramic powder PZT (lead-zirconate-titanate) which is uniformly distributed within an epoxy resin matrix [2]. The idea of the 0-3 piezoelectric composite was to incorporate the sensor into the adhesive layer as part of the adhesive without greatly affecting the mechanical properties of the bond. The lap joints were tested and characterised using the dynamic four-point bending test, showing an increase of the output signal as the applied strain amplitude is increased.

References

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