

Measurement Note

Validation of Strain Gauge, Digital Image Correlation and Dilatometry Procedures for Measuring CTE

Abstract

Accurate values for the coefficient of thermal expansion (CTE) are crucial in the design of many components operating in thermal environments. In electronic systems for example, CTE mismatch is a key driver for thermally induced mechanical stresses, which can lead to premature component failure.

Conventional dilatometry is an accepted method for measuring CTE, but it cannot be readily used for large components or for electronic systems such as printed circuit boards (PCBs). Procedures have been developed at NPL to determine the CTE of such components using strain gauge techniques and digital image correlation (DIC). This note summarises some of the results that have been produced, together with some practical tips and issues that should be considered using these novel techniques.

The work described in this Measurement Note provides validation data on 3 MMC candidate substrate materials, in advance of more detailed studies applying the techniques developed to measure CTE at the system level. For the materials examined, the results for the strain gauge and image correlation and dilatometry techniques were in good agreement, validating the procedures that have been developed.

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