

Strength and Reliability Estimation of LTCC Material With and Without Metallic Features

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The use of low temperature cofired ceramics (LTCC) is a very attractive technology for advanced packaging. Strength values for a commercial LTCC material were measured over six orders of stressing rate magnitude in dry (0-2% RH) and wet (>98% RH) environment, using a ring-on-ring biaxial-flexure samples and four-point bend samples. Indentation strength measurements over four orders of stressing rates in water were also measured for four point bend bars. These data were analyzed to obtain the empirical sub-critical crack (SCG) growth parameters, and fractographic analysis was used to pin-point the failure origins. The results from the biaxial testing differ from the four point bend testing, indicating that the material response to cracking in humid environments is dependent on the stress state. The surface failure mode four point bend SCG results are comparable to those obtained from the indentation tests. Testing of LTCC material with metal vias and other features led to strength decreases of as much as 50%. The strength loss is attributed to the residual stress state in the ceramic due to the thermal and elastic mismatched metallic inclusion. Results for SCG for the materials in the presence of metal vias will also be presented, and implications of our data for lifetime estimation will be discussed.

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