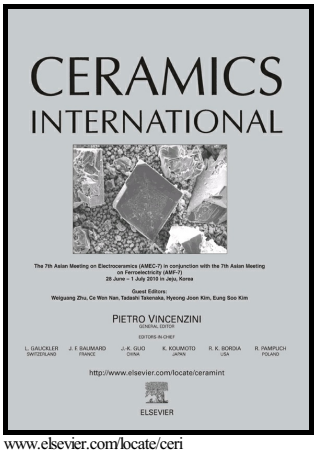

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Effect of high temperature cycling on both crack formation in ceramics and delamination of copper layers in silicon nitride active metal brazing substrates

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Abstract

Crack formation in Si_3N_4 active metal brazing (AMB) ceramic substrates and delamination of copper layers on the AMB substrates subjected to temperature cycling from -40 to 250 °C were investigated to evaluate the reliability of these substrates under harsh environments. Acoustic scanning microscopy (ASM) observation of the Si_3N_4 substrates with 0.30 mm thick Cu layers revealed crack formation beneath the corner of the copper plate after 100 cycles, whereas no cracks were detected on the Si_3N_4 substrate with a 0.15 mm thick Cu layer, even after 1000 cycles. The residual bending strength of the Si_3N_4 substrates with 0.30 mm thick Cu layers was 78% of the as-received substrate after 10 thermal cycles, and gradually decreased with an increase in the number of thermal cycles until ca. 65% of the initial strength after 1000 cycles. The Si_3N_4 substrates with 0.15 mm thick Cu layers exhibited a gentler degradation of residual strength than those with 0.30 mm thick Cu layers. In contrast, the residual bending strength of AlN-AMB substrates