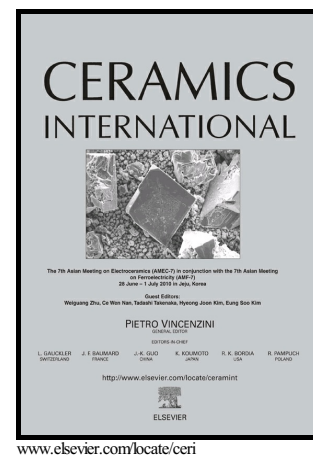


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Improved resistance to thermal fatigue of active metal brazing substrates for silicon carbide power modules using tough silicon nitrides with high thermal conductivity

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## Abstract

The effect of temperature cycling from  $-40$  to  $250$  °C on active metal brazing (AMB) substrates for power modules was investigated using newly developed silicon nitride ceramics with both high thermal conductivity of  $140 \text{ W m}^{-1} \text{ K}^{-1}$  and superior fracture toughness of  $10.5 \text{ MPa} \cdot \text{m}^{1/2}$ . Other types of AMB substrates made of AlN or  $\text{Si}_3\text{N}_4$  were also tested for comparison. Both visual inspection and acoustic scanning microscopy (ASM) observation of the new  $\text{Si}_3\text{N}_4$ -AMB substrates after 1000 cycles revealed almost no cracks. In contrast, the  $\text{Si}_3\text{N}_4$ -AMB substrates with lower fracture toughness experienced crack initiation beneath the corner of the copper plate. The degradation in the bending strength after 1000 cycles was negligible for the new  $\text{Si}_3\text{N}_4$ -AMB substrates, whereas the

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