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論文

高純度アルミニウムを利用した高耐熱パワーデバイス実装構造における信頼性評価

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Reliability Study of High-Temperature-Resistant Mounting Structure Using High Purity Aluminum for Power Devices

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Abstract

In this study we propose a new mounting structure for SiC power devices that operate at high temperatures and evaluate its reliability. In this new structure the stress relaxation function rests with the circuit metal on the substrate rather than the joint layer, so high purity aluminum, which has similar characteristics to conventional solder, was chosen as the circuit metal. By conducting a Finite-Element-Method analysis using the measured nonlinear material properties of aluminum, it was possible to make a stress–strain evaluation of the structure. In order to investigate the practical fatigue properties of aluminum we devised a mechanical test method which makes local strain concentration of the chip joint appear, and this method enabled prediction of the thermal fatigue life cycle of the structure. Moreover, a harsh Thermal Cycle Test of the chip mounting samples was conducted between −50 and 300 degrees Celsius, and a positive correlation was obtained between the predictions and the test results.

Key Words: *Reliability, High-Temperature-Resistant, SiC Power Device, High Purity Aluminum, FEM, Coffin–Manson's Law, Thermal Fatigue*