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Analysis of thermomechanical stresses and strains in power electronic packages subjected to temperature gradients

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Power electronics devices have become increasingly relevant in modern engineering applications, playing a crucial role in enhancing energy efficiency, control precision, and system reliability across various industries. Modern power electronics packages for automotive applications are required to withstand severe temperature gradients, due to their significant specific power and the consequent heat generation, localized in the active volumes of the package and transferred in the surrounding zones of the package. The multilayered layout of such packages, with very different materials stacked together, causes remarkable discontinuities in the mechanical and thermal properties. The remarkable temperature gradients and the sharp discontinuities in mechanical properties may induce significant thermal stresses and permanent deformations, possibly affecting the operativity of the whole package and limiting its durability. In this study, a numerical analysis is conducted to evaluate the mechanical response of a power electronic package subjected to temperature fields representative of its operating conditions. The analysis highlights potential critical areas by examining the actual strains and stresses that develop within the package.

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