

Thermomechanical Effects of the Packaging Molding Process on the Chip in Integrated Circuits

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Abstract

Usually, in integrated circuits, the chip is brazed on leadframe and then, a (black) polymer resin is molded around to create the packaging. On the first hand, the molding process at high temperatures will induce thermomechanical stress on the chip. As the leadframe, the chip and the braze have all different thermoelastic properties, these stress can be critical for the chip connections [1]. On the other hand, we can also consider, during the injection of the hot fluidic polymer, the mechanical interaction between the fluid and the chip. This can also induce deformation of the chip on the leadframe.

To illustrate those eventual problems, we designed simulated studies with the COMSOL Multiphysics® software, using industrial cases from ST Microelectronics molding process and integrated circuits. This paper will describe the mechanical consequences of the molding process for the packaging of integrated circuits, which are critical for their reliability [2].

This paper focuses on the prediction of the packaging process induced deformation and stress, that can be achieved under different process conditions. We expect to estimate whether the polymer molding step in the manufacture of an Integrated Circuits actually critical for its reliability or not.

Reference

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- [3] W. D. Van Driel, J. H. J. Janssen, G. Q. Zhang, D. G. Yang, L. J. Ernst, Packaging induced Die stresses, effect of chip anisotropy and t-dependent behavior of a molding component, ASME vol 125, December 2003.
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- [6] COMSOL's MEMS Module Product presentation, www.comsol.com

Figures used in the abstract

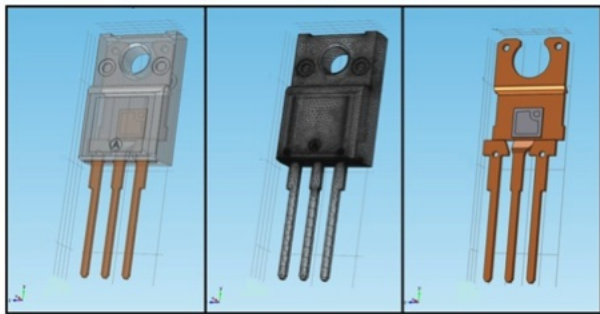


Figure 1: Figure 1 : View of the full system including leadframe die and the pack (left), the system meshed (mid.), and without the pack (right)

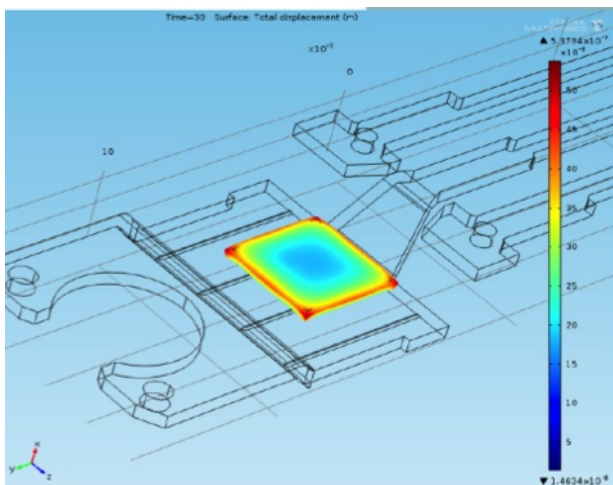


Figure 2: Figure 2: Simulation of the deformation of the die on the packaging molding conditions

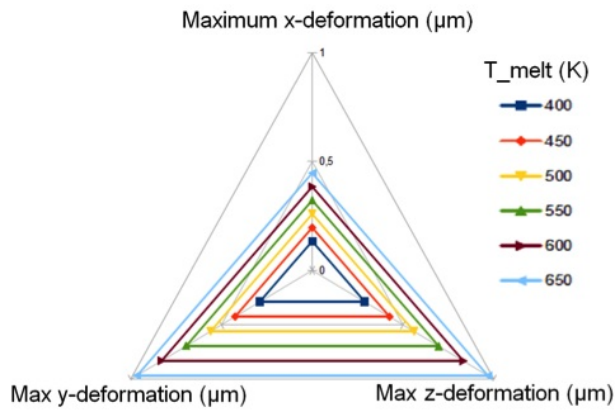


Figure 3: Figure 3: 3D-deformation on the die depending on the process temperature T_{melt} : the x-direction is normal to the brazing

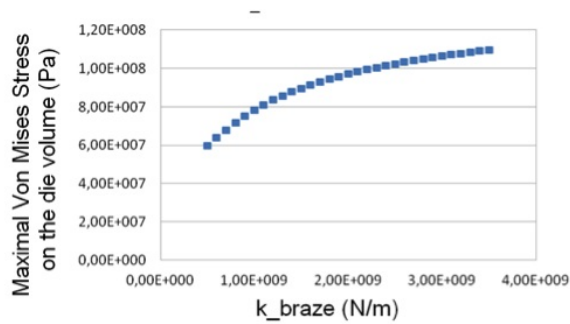


Figure 4: Figure 4 : Estimation of the maximum of Von Mises stress on the die versus the spring stiffness k_{braze} value