G09.10

Numerical Simulation of Underfill Flow for Flip Chip in a IC Package

*Shin-ichiro Tanifuji (a), Tomohisa Hashimoto (b)

(a) *Plamedia Corporation, Japan*
(b) *Kyoto Institute of Technology Venture Laboratory, Japan*

Flip chip encapsulation is a standard operation in IC package and become a major subject for industrial applications in the field of microelectromechanical system (MEMS). We have been developing computational fluid dynamics software to predict thermal flow phenomena of the thermosetting polymer melt in the flip chip packaging process. The thermal flow phenomena were modeled as the moving boundary problem of the unsteady non-isothermal free surface flow. The variation of the viscosity due to the thermosetting was taken into account by using the Kamal chemical reaction model and the Makosco viscosity model. The tracking algorithm of free surface flow is based on VOF method with the surface tension model and the wall adhesion model to represent the capillary force. Numerical simulations were performed to estimate the unsteady behavior of the underfill material compressed by the pre-heated Integrated Circuit (IC) chip. In the initial stage, the temperature dependence is dominant in the variation of the viscosity. As time increases, the thermosetting reaction increases the viscosity and greatly influences the flow behavior. The results of numerical simulation show the reasonable agreement with an experimental observation and suggest that the thermosetting reaction, the surface tension, the bump patterns and the movement condition of the IC chip have essential roles to determine the final shape of the underfill material.