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Numerical simulation of underfill encapsulation process based on characteritsic split method

Abstract

Electronic packaging protects the integrated circuit chip from environmental and mechanical damages. Underfilling encapsulation is an electronic packaging technology used to reinforce the solder joints between chip and the substrate. For better mould design and optimization of the process, flow analysis during the encapsulation process is the first necessary step. This paper focuses on the study of fluid flow in underfilling encapsulation process as used in electronics industry. A two-dimensional numerical model was developed to simulate the mould filling behaviour in underfilling encapsulation process. The analysis was carried out by writing down the conservation equations for mass, momentum and energy for a two-dimensional flow in an underfilling area. The governing equations are solved using characteristic based split (CBS) method in conjunction with finite element method to get the velocity and pressure fields. The velocity field was used in pseudo-concentration approach to track the flow front. Pseudo-concentration is based on the volume of fluid (VOF) technique and was used to track fluid front for each time step. A particular value of the pseudo-concentration variable was chosen to represent the free fluid surface which demarcates mould compound region and air region. Simulation has been carried out for a particular geometry of a flip-chip package. The results obtained are in good agreement with the available numerical and experimental values and thus demonstrate the application of the present numerical model for practical underfilling encapsulation simulations..

Keywords — Simulation, underfill encapsulation, Characteristic Based Split (CBS) method, Finite Element Method (FEM), Volume Of Fluid Technique (VOF), front tracking