Title and short summary

Fluid Flow Manipulation and Its Application in Electrionics Packaging

Xiaobing Luo

School of Energy and Power Engineering, Huazhong University of Science and Technology, Wuhan, China, 430074

Electronics packaging is a complicated science and engineering technique. It mainly concerns optics, thermology, materials, mechanics, electronics, packaging process and fluid flow. Its main functions include mechanical protection, external signal and electrical connection, heat dissipation and optical parameter control. Fluid flow is a basic issue in numerous electrical packaging processes, such as chip bonding, solder reflow, underfill injection and silicone/phosphor encapsulant coating. The flow characteristics of the fluid determines the morphology and location of the fluid layer, and further affects the optical, mechanical and thermal performance of electrical devices. Therefore, obtaining a full understanding of the fluid flow mechanism enables advancements and developments of electronics packaging. In this topic, the emphasis is placed on the tiny droplet flow manipulation and its application in electronics packaging. Firstly, numerical modeling of tiny droplet on solid surface by lattice Boltzmann method (LBM) and volume of fluid (VOF) method will be introduced. Based on the numerical modeling, the effect of the fluid properties (surface tension, viscosity and weber number) and surface properties (temperature, topography and wettability) on the droplet-surface interaction could be analyzed in detail. Secondly, experimental means to capture the faster fluid flow process of tiny droplet on solid surfaces will be introduced. The experimental results could provide a clearer insight of the droplet-surface interaction, so as to verify the accuracy of the numerical models as well as to promote the models. Finally, the application of fluid flow manipulation in electronics packaging, especially in the silicone-phosphor coating process, will be presented. Taking the example of light-emitting diodes (LEDs) packaging, the silicone-phosphor coating process determines the parameters of the silicone/phosphor encapsulant layer, such as the phosphor recipe, size, concentration, distribution and the silicone/phosphor encapsulant layer geometry, and further influence the optical and thermal performance of the LEDs.