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Reducing Component Stress during Encapsulation of Electronics: A Simulative Examination of Thermoplastic Foam Injection Molding

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Abstract : The direct encapsulation of electronic components is an effective way of protecting components against external influences. In addition to achieving a sufficient protective effect, there are two other big challenges for satisfying the increasing demand for encapsulated circuit boards. The encapsulation process should be both suitable for mass production and offer a low component load. Injection molding is a method with good suitability for large series production but also with typically high component stress. In this article, two aims were pursued: first, the development of a calculation model that allows an estimation of the occurring forces based on process variables and material parameters. Second, the evaluation of a new approach for stress reduction by means of thermoplastic foam injection molding. For this purpose, simulation-based process data was generated with the Moldflow simulation tool. Based on this, component stresses were calculated with the calculation model. At the same time, this paper provided a model for estimating the forces occurring during overmolding and derived a solution method for reducing these forces. The suitability of this approach was clearly demonstrated and a significant reduction in shear forces during overmolding was achieved. It was possible to demonstrate a process development that makes it possible to meet the two main requirements of direct encapsulation in addition to a high protective effect.

Keywords : encapsulation, stress reduction, foam-injection-molding, simulation
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