Multimaterial Micro Injection Molding

At the present state of technologies, the standard micro injection moulding is an established and widely used process whereas the special variants of micro moulding processes like multicomponent micro injection moulding, micro insert moulding, micro powder injection moulding etc. are becoming more and more popular. These especial processes are seen as production methods which provide the advantages beyond the capabilities of standard micro moulding process. The demands for multicomponent micro parts are growing rapidly especially in the field of automotive, electronics, medical instruments, optical industries, consumer electronics and so on. Micro/nano manufacturing products, and their associated production equipment, are expected to represent a market of over €420 billion euros by 2035 [1]. The multimaterial and multifunctional integrated products are becoming in most cases an economic and technological key factor for the majority of advanced applications. The success of the future products and processes will highly dependent on manufacturing systems that can reliably and economically combine different materials to produce multicomponent and multifunctional micro products. By combining different materials, it is possible to manufacture components featuring a wide spectrum of properties. The continuous trend towards miniaturization and multi-functionality embedded in products calls for more and more functionally versatile multimaterial components for the future micro systems. As handling and assembly are difficult and expensive procedures in micro technology [2, 3], methods to reduce mounting efforts have high economic significance. By merging of shaping and assembly processes into a single step by multimaterial (also known as multicomponent) moulding, a significant economic progress can be made in micro manufacturing.

Considering the above mentioned potential of multicomponent micro injection moulding, this chapter will focus on the different aspects of multimaterial micro injection moulding. Special emphasis will be given to the two component micro injection moulding as this is the basic process of multicomponent micro injection moulding. The challenging task for the two component moulding is to find a material pair which fulfils the diverse requirements for the engineering application and at the same time has a reasonably good bond and sharp interface between the two polymer materials. Many fascinating applications of two component or multi component polymer parts are restricted due to the weak interfacial adhesion and interface quality of the polymers. A thorough understanding of the factors that influence the bond strength of polymers is necessary for multi component polymer processing. This chapter focuses on the parameters that influence the quality of polymer-polymer bonding, interface and analyses the relations between the bonding and the interface quality with the special focus on micro scale applications. The results and discussion presented in this paper will provide a guideline for the multicomponent micro moulding for a wide range of industrial applications.

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