

Volume production at industrial scale of miniaturised multi-material 3D components or sub-components (polymer-polymer, metal-polymer, metal-metal, polymer-ceramics,...) still offers important challenges to overcome (until now , the main effort has been focused on the development of high quality and accurate mass production/replication technologies for micro mono-material parts), challenges not only in terms of precision manufacturing (precision engineering miniaturised components (micro injection moulding and hot-embossing) , although are quite developed technologies, would need an improvement (precision, high throughput,...) and also be part of a process chains which integrates additional technologies in order to be cost efficient and fulfil the requirements the market of microsystem-based products demands (new material combinations with complex geometric forms and increased functionalities).

Currently, besides the achieved important advances in terms of time and cost reduction in precision tool making and quality control activities (reaching a reduction of 50% in some cases), multi-material micro-system manufacturing processes still show to be time and cost consuming mainly for assembling activities and back end processes (35-60% of the total manufacturing costs come only from the assembling), so further research efforts in alternative and more integrated manufacturing concepts(over-moulding of micro-components and in-mould assembly technology would avoid the assembly step) are needed.

Moreover, European SMEs, given the lack of technological knowledge and technical capacity they suffer, in most cases, related to the development of multi-material micro-products, demand a joint effort in the development of new/alternative solutions to overcome the present challenges in terms of quality, improved functionality and cost-effective miniaturised components. They need to rapidly react to the market and to customer's needs by fast development of complex and high functional micro-manufacturing cost effective processes in order to succeed in competition with low-wage countries. In this collaborative research effort, European SMEs key role will be essential due to their enviable view of the market requirements.

To answer this problem the development of high-throughput and cost-efficient process chains based on the integration of advanced and precise mass production technologies (polymer replication) for quality multi-material micro-components and back-end processes for additional functionalities of the final products, are needed. These high-throughput production processes should consider the following aspects:

- Improved volume production, not only from the standpoint of the necessary accuracy and performance of the process, but also regarding the interaction/bonding of the different materials which make up the produced parts and the possibility of selective functionality of their surfaces.
- Analyse, where it is necessary, the most suitable back-end processes for the application's required functionality (new or additional), taking into account the features (shape, materials ...) of the multi-material replicated parts and perform the necessary developments.
- The integration of the different processes for the multi-material micro-component production in high-throughput process chains are able to accelerate production of multi-component devices avoiding some time consuming steps (assembly) and to obtain an important reduction of needed supply chainspace and manufacturing costs.