Manufacturing routes for disposable polymer blood diagnostic microfluidic systems

The future vision of multi-analysis point of care testing (POCT) shows a hand-held device that patients can use with an ease similar to current blood sugar test systems. Additionally, the mobile instrument would require transfer of the measured test results wirelessly to the doctor’s office, thus enabling patient-friendly and comfortable control, e.g., for drug efficiency monitoring of chronic diseases. For such a bright vision, there is a strong need for the realisation of new technologies. This article presents the results of the Polymer Technology Division of the European Network of Excellence 4M (Multi-Material Micro Manufacture) that are relevant to the technology for disposable polymer parts for Micro-Tele-BioChip (μTBC) medical platforms. Combining two separation mechanisms, a novel micro channel design was developed. The separation unit is based on a micro channel bend structure where typical channel dimensions are 20 µm for the plasma channel width, and 50-75 µm for the cell channel. The height of all channels is 100 µm. The micro channel bend works simply on physical and hydrodynamic separation mechanisms without integrated actuators like pumps or valves. For mass-fabrication of low-cost and disposable μTBC devices, the micro injection moulding process was selected and therefore a micro tool was required. To overcome the limitations of current existing micro tooling capabilities, a new generation of micro hybrid tooling technologies for micro replication was developed. A metrological approach was applied to standardize the different tooling methods employed. The micro tools were then tested with different polymers on different injection moulding machines. The paper provides a comparison of these technologies with a particular focus on the obtainable feature sizes, surface finish, and aspect ratios of both micro tools and micro moulded parts.