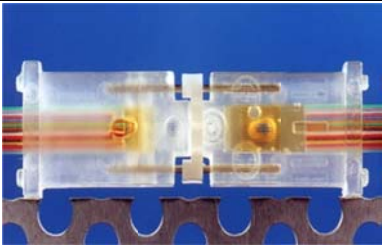

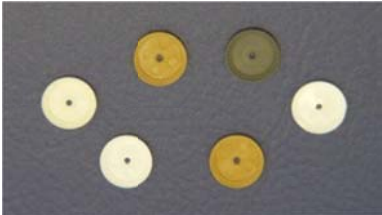
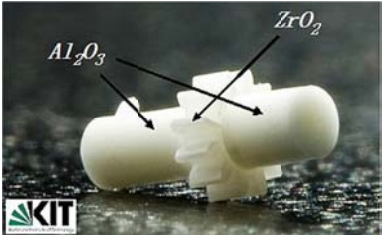


Replication

## Micro-Injection Moulding

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<b>Material class:</b>	Silicon	Polymer X	Metal X	Ceramic X	Glass	Organic X	Other X
<b>Short technology description:</b>	Injection moulding allows the low cost mass fabrication of large microstructured as well as singular micro parts using prestructured mould inserts as master. In both cases very high geometric accuracies and smallest tolerances can be achieved using e.g. LIGA-fabricated mould inserts. Besides the replication of polymers powder injection moulding (MicroPIM) is under development for the micro fabrication of components made of a large variety of metals or ceramics. Two-component injection moulding reveals strong advantages with respect to reduced mounting expenditures and the capability to produce multi-functional devices.						
<b>Typical structures and designs:</b>		<b>PMMA 16 multifiber connector for multimode application</b>					
		<b>Prism demonstrators made of different transparent thermoplastics (PMMA, PMMI, PC)</b>					
		<b>Injection moulded ZrO<sub>2</sub> (white), Cu (brown) and steel (grey) micro gear wheel housings</b>					
		<b>Combined gear wheel / shaft sample made by two-component injection moulding of alumina (shaft) and zirconia ceramic (gear wheel)</b>					
<b>Special features:</b>	<ul style="list-style-type: none"><li>- Cycle times &lt; 5 s – 6 min</li><li>- Largest replicated aspect ratio:<ul style="list-style-type: none"><li>- 17 for free standing structure (height 2000 µm, width 115 µm)</li><li>- 25 for buried structure (height 250 µm, width 10 µm)</li></ul></li><li>- Smallest replicated structural detail: &lt; 200 nm for AR = 1, in case of lower AR replication minima decrease correspondingly</li><li>- Special variants like insert injection mould, compression injection moulding, and inmould-labelling (under development)</li><li>- Fabrication of metal and ceramic parts via powder injection moulding under development</li><li>- Injection moulding of in-house developed new functional polymer composites and feedstock systems</li></ul>						

<b>Limitations, constraints:</b>	<ul style="list-style-type: none"> <li>- Relatively large efforts for tooling necessary</li> <li>- Replication process very sensitive to mould insert's surface roughness</li> <li>- Side wall draft angle or ejector slope is recommended for larger aspect ratios depending on the mould insert's roughness</li> <li>- Limited undercuts</li> <li>- No hollow parts in one step fabrication possible</li> </ul>
<b>Material examples:</b>	<ul style="list-style-type: none"> <li>- 1- and 2- component injection moulding with polymers on advanced level, PIM for metal and ceramic parts usually requires development efforts</li> <li>- Polymers: nearly all thermoplastics and thermoplastic elastomers</li> <li>- Metals: PM steels like 17-4PH and 316L, Cu, W and W-alloys, hard metals</li> <li>- Ceramics: oxide ceramics like ZrO<sub>2</sub> and Al<sub>2</sub>O<sub>3</sub>, Si<sub>3</sub>N<sub>4</sub>, mixture ceramics like TiN-Al<sub>2</sub>O<sub>3</sub> with defined electrical conductivity</li> </ul>