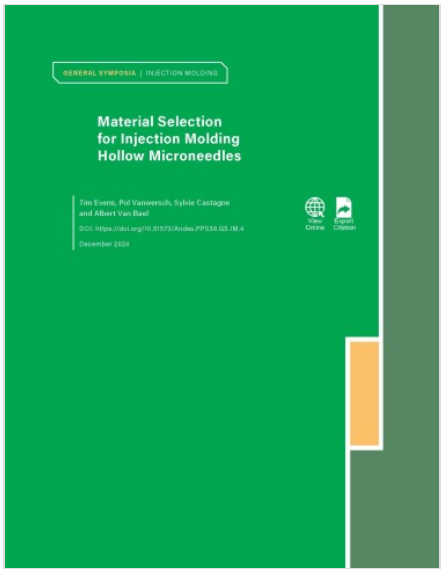
Material Selection for Injection Molding Hollow Microneedles

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Sinopsis

Hollow microneedles are designed to perform intradermal medical substance delivery or fluid extraction, with polymers standing out as cost-effective materials for mass production via injection molding. However, existing research lacks a comparative analysis of different polymers in terms of processability and performance in skin penetration tests. This study addresses this gap by evaluating hollow microneedles fabricated from five biocompatible thermoplastic materials: polycarbonate (PC), polybutylene terephthalate (PBT), polylactic acid (PLA), polyamide 12 (PA12), and glass-fiber reinforced polyarylamide (PARA). Significant dif ferences in replication fidelity were found among the thermoplastics, with a higher calculated solidification time resulting in better replication fidelity due to extended deformability during the packing phase. PBT microneedles deformed during demolding and were excluded from penetration tests. Penetration tests on piglet ears showed no penetration for PA12 and PLA microneedles due to deformation of the needles. PARA demonstrated consistent penetration results, while PC exhibited an inconsistent penetration behavior, with some needles success fully penetrating while others deformed. High mechanical properties were found to be critical for achieving consistent and successful penetration.



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