

先進微型模腔製造工藝

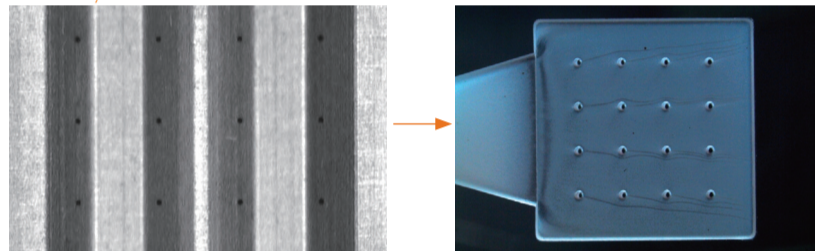
Advanced Micro Mold Cavity Manufacturing Technique

一項為製造微型模腔而特別設計的工藝，再以微注塑方法生產高精密微型部件
A manufacturing technique specifically designed for making micro mold cavity for the production of precision micro parts by injection molding

長久以來，生產高精密微型部件是工業界的一項挑戰。新近的微注塑技術開發，進一步將此項工序變成既可靠且具成本效益的生產方法。然而，能否成功地應用微注塑生產，很多時取決於我們所設計和製造的微型模腔有多好和多準確。傳統的機械加工方法遠遠不能滿足製造微型模腔的技術需求。非傳統方法如光刻蝕技或電化學加工，主要是為製造某些特類微型結構而設。相對於微型模腔，由於有各微型部件形狀上的不同，我們因此創立了一系列結合微加工和微電鑄技術的製造工藝，能應付更多不同的微型特徵、深寬比和表面要求。過往由高價工序生產的精密微型部件，現今可以低廉成本的微注塑方法代替。

皮秒激光的範例一：微針

Case Study I of Pico-second Laser: Micro Needle

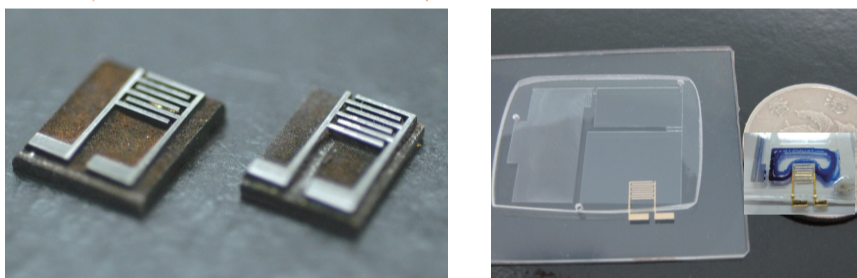


皮秒激光製作的微型斜孔
入口：200微米
出口：110微米
Pico-second Laser Taper Hole Drilling
Entrance: 200 micron
Exit: 110 micron

塑料注塑的表皮藥物傳送空心微針
Plastic Injectable Transdermal Drug
Delivery Hollow Microneedles

皮秒激光的範例二：微生物晶片

Case Study II of Pico-second Laser: Micro-Biochip



皮秒激光燒溶技術製成的印章
Pico-second Laser Ablated Stamper

熱屏微型泵
Hot Screen Micro Pump

Production of precision micro parts has always been a challenge to industry. Latest developments in micro molding technology have made the process a reliable and cost effective production method. However, successful application of micro injection molding is frequently determined by how good and accurate we are in the design and manufacture of micro mold cavity. Conventional machining methods are far from satisfactory. Non-conventional methods like photolithography or electrochemical machining have been developed primarily for certain specific kinds of microstructures. Since the geometry of micro mold cavity differs from one micro part to another, we have successfully developed a manufacturing technique that combines micromachining and advanced micro-electroforming together to embrace a wider range of feature size, aspect ratio or surface finish. Precision micro parts once made by expensive processes can now be produced by micro injection molding at a much lower cost.

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特色與優點

微型模腔製造工藝的優點：

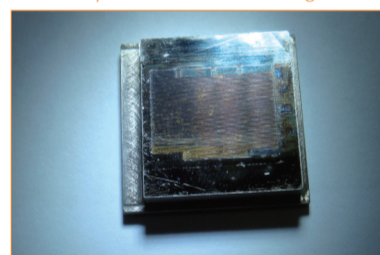
- 靈活性－應用不同的微加工方法配合不同的電鑄用母模
- 簡單性－以電化學沉澱方法製造微型模腔
- 準確性－所生成的微型模腔與被複製的微型結構完全一樣
- 一致性－可多次重覆使用
- 有效性－可同時製造多個微型模腔

應用

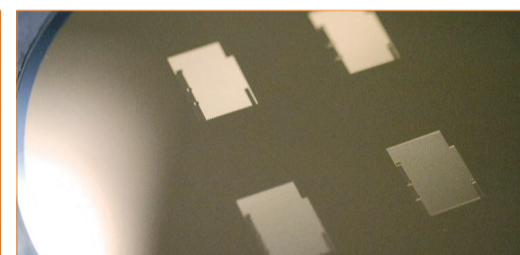
此項工藝的開發目的是製造微型模腔，用作生產精密微型部件。這裡所指的微型部件，其重量或許是少於 1 毫克，其尺寸或許是毫米大小，但帶有精細和微型等級的特徵。應用微型部件的範圍十分廣闊，例如馬達工業的微型轉子、醫療工業的微型過濾器 and 通訊工業的光纖連接器等。

微電鑄的範例

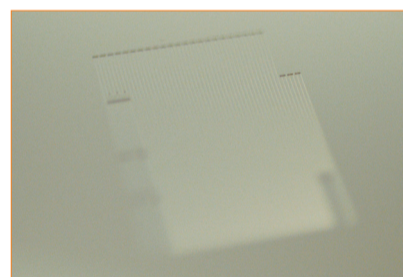
Case Study of Micro Electroforming



微電鑄製作的模具鑲件 (鎳)
Electroformed Mold Insert (Nickel)



塑料注塑的微生物晶片
Injected Plastic Micro Bio-chip



利用濺鍍技術製造的純金種子鍍電層應用於
微生物晶片模具
Sputtered Gold Conductive Seed Layer of
Micro Bio-chip Mold



利用微電鑄加工的微生物晶片模具
Micro-electroforming process of Micro Bio-chip Mold

Special Features and Advantages

Advantages of the developed micro mold cavity making technique:

- Flexible – A wider range of micro structures is possible at a choice of micromachining methods
- Simple – Micro cavities are made by electrochemical deposition
- Accurate – Micro cavity made is mirror image of the micro structure being replicated
- Consistent – Replication is repeatable
- Efficient – More than one micro mold cavities can be made simultaneously

Applications

The developed technique is aimed at producing micro mold cavity designed for the production of precision micro parts. The micro parts in question may be weighing less than a milligram or of millimeter size but carrying fine micron scale features. Applications of micro parts are wide ranging. Some examples are micro rotor in the motor industry, micro filter in the medical industry and optical fiber connector in the communication industry.