

# 光學微結構的精密微納印壓設備 Micro-embossing Equipment for Precision Optical Microstructures

結合類石墨烯塗層、局部加熱及溫度傳感系統的革命性快速玻璃壓印加工技術  
Revolutionary rapid glass embossing technology with graphite-like carbon film,  
localized heating and temperature sensing system

專利申請編號: 201710605018.8 (中國), 201710679861.0 (中國),  
201710520923.3 (中國), 201810161255.4 (中國), 201810213125.0(中國)

## 特色與優點

- 設備的成本是傳統玻璃成型機的三分之一
- 提供快速加熱和冷卻工藝，縮短週期時間
- 實現壓印過程的瞬時溫度控制
- 設備內部較低的溫度令機器的設計更簡化
- 可使用金剛石車削矽模具，以替代昂貴的碳化物模具
- 比傳統的紅外線加熱技術省電68倍

## 應用

能夠精準地製造非球面小型透鏡，尤其是微型透鏡陣列，可應用於數碼投影機、打印機、手機、全光學相機、太陽能板及3D成像和激光源之間的耦合等

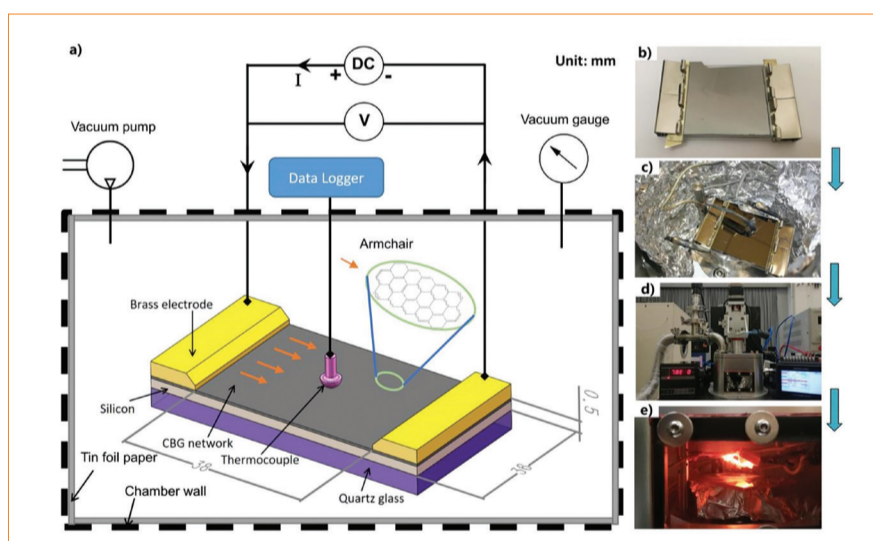
## 獎項

- 中國光學工程學會科技創新獎 - 二等獎 (2019年7月)
- 2018 香港工商業獎 - 設備及機器設計優異證書 (2018年12月)
- 第46屆瑞士日內瓦國際發明展 - 金獎 (2018年4月)

傳統的光學零件是通過用近紅外線加熱的熱壓縮過程而成型的，壓模的加熱和冷卻過程都很緩慢，消耗大量能量。理大開發的嶄新精密微納印壓設備只需運用少量能量，便可於玻璃工件上製成具光學微結構的光學零件。這台設備以碳化鎢和矽膠作為壓模材料，可以快速加熱及對工件溫度進行實時測量，解決了傳統加工方法的主要問題，如加工緩慢、模具製造和壓力控制困難等，能夠精準而快速地壓印非球面小型鏡頭和光學微結構，如微鏡陣列等。



精密微納印壓設備  
The micro-embossing equipment



微結構的超精密加工  
Ultra-precision machining of microstructures

Optical components are conventionally moulded by infrared heating in a hot compression process, which takes a long time in heating up and cooling the materials while consuming of a lot of electric power. Our micro-embossing equipment can produce micron-level micro-structural optical components in glass with less electric power. It can rapidly heat up glass and measure the temperature of workpieces in situ using the graphene coating with silicon as the die material. It solves the key problems in conventional production process, e.g. slow packaging cycle, difficulties in mould cavity melting and moulding pressure accuracy control. The equipment enables rapid and accurate impression of small aspheric lens and fine optical microstructures such as microlens array.

### Principal Investigator

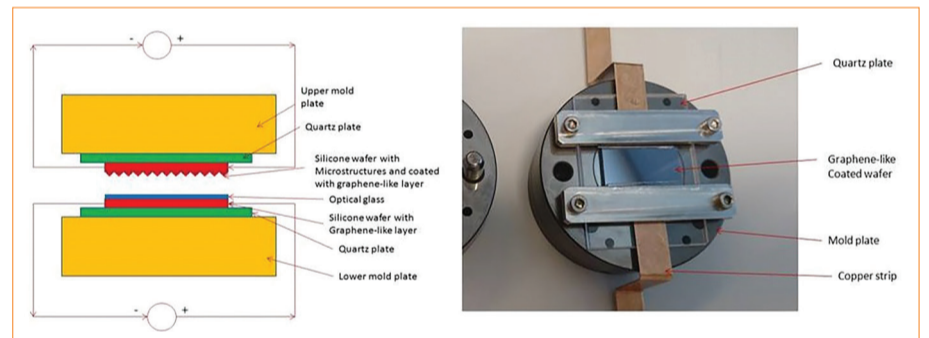
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把鍍上類石墨烯的硅片加熱  
Heating of graphene-like coated wafer

Patent Application No.: 201710605018.8 (China), 201710679861.0 (China),  
201710520923.3 (China), 201810161255.4 (China), 201810213125.0(China)

## Special Features and Advantages

- Low cost: 1/3 of that of a conventional glass moulding machine
- Fast heating and cooling processes and shorter moulding cycle
- Instantaneous temperature control during the embossing process
- Streamlined design enabled by lower chamber temperature
- Replacement of expensive carbide mould with more economical silicon mould
- 68 times more energy-saving than infrared heating

## Applications

Accurate and precise fabrication of small aspheric lens, especially microlens array, for use in digital projectors, photocopiers, mobile phones and plenoptic cameras, photovoltaics, 3D imaging and coupling between laser sources, etc

## Awards

- Second Prize of Technical Inventions Award - CSOE Innovation Awards (July 2019)
- Certificate of Merit of 2018 Hong Kong Awards for Industries - Equipment and Machinery Design (Dec 2018)
- Gold Medal - 46th International Exhibition of Inventions of Geneva, Switzerland (Apr 2018)



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