

# 利用 X 光光刻技術製備凹面型微光柵分光儀之技術研究

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## 摘 要

本研究主要探討以 SU-8 作為高感光對比 X 光光刻光阻的可行性。研究結果顯示，應用 SU-8 對於 X 光呈現高感光對比的特性，X 光光罩可使用較厚的鼓膜與較薄的吸收體，其結果將可有效降低傳統 X 光光罩製程的困難度及複雜性，大幅提升 X 光微加工技術的工業應用潛力。實驗中利用田口統計方法針對 SU8 光阻製程進行最佳化，成功的製作出 3 $\mu\text{m}$  週期、125 $\mu\text{m}$  厚的凹面型微光柵結構。結果顯示，光刻微結構側壁不但非常筆直( $>89.9^\circ$ )，而且其表面粗糙度也相當平整( $R_a < 5\text{nm}$ )。光學量測結果顯示，應用 X 光光刻技術製作出的 3 $\mu\text{m}$  週期凹面型微光柵分光晶片，已經可以達到 0.4nm 以下的分光解析能力，滿足現有光通訊頻道間距的要求。若結合高分子模造技術，凹面型微光柵分光晶片將可被大量製作，並且降低製作成本。其在將來的通訊或是生化檢測的應用上都是值得期待的。

# **A Study on X-ray Lithography Technique for the fabrication of micro cylindrical concave grating demultiplexer**

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## **Abstract**

In this study, the feasibility of using SU-8 resist as a resist for high-resolution X-ray lithography was investigated. Due to the high contrast and sensitivity behaviors of the SU-8 resist, the result showed that its corresponding mask absorber can be thinner and the mask membrane can be thicker. As a result, the fabrication processes of the X-ray mask can be much simpler and easier than ever before. The fabrication yield of the X-ray mask also can be remarkably improved. After lithographic process optimization, a cylindrical concave grating with a grating constant of 3  $\mu\text{m}$  and a thickness of 125  $\mu\text{m}$  was successfully fabricated. Results show that the high aspect-ratio grating not only has perpendicular sidewall ( $>89.9^\circ$ ) but also reveal excellent surface quality ( $R_a < 5\text{nm}$ ). Optical measurement results indicate that resolving resolution of the concave grating is better than 0.4 nm, which is good enough for communication application. Since the cylindrical grating can be mass-fabricated via polymer molding process (or “LIGA” process), the potential in communication and bio-chemical analysis applications is highly expected.