

# Optical waveguide devices

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Modulators, switches and deflectors have been demonstrated in bulk crystals such as  $\text{LiNbO}_3$ . However, a larger variety of devices with higher efficiency can be made by introducing optical waveguides into  $\text{LiNbO}_3$ . A convenient method for doing so makes use of diffusion of titanium through photolithographic masks. High speed modulators, switching arrays, multiplexers, tunable filters, and signal processors have all been fabricated in  $\text{Ti:LiNbO}_3$  using a directional coupler geometry. An all-optical bistable switch, which may have logic or repeater applications, has also been fabricated using a cleaved crystal orientation. Various properties of these devices, such as loss, electrooptic coefficient and optical damage, have been measured.

Strip waveguides have also been formed in heteroepitaxial semiconductor materials by means of ridge-loading and other techniques. Directional coupler-type switches have been demonstrated. In addition, lateral-confinement, single-mode waveguide lasers have been made that operate at wavelengths as long as  $1.6 \mu\text{m}$ .

## 光 波 导 器 件

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利用  $\text{LiNbO}_3$  等块状晶体已制成了调制器、开关和偏转器样品。但通过将光波导引入  $\text{LiNbO}_3$  的方法却可制得品种更多、效率更高的器件。办法之一是利用掩模光刻扩散钛。使用定向耦合结构完全可以在  $\text{Ti:LiNbO}_3$  中制成高速调制器、开关列阵、多路调制器、调谐滤波器及信号处理器。利用解理的晶体取向还制成了可应用于逻辑或中继器的全光双稳态开关。已测定了这些器件的各种性质，如损耗、电光系数和光损伤。

使用脊形负载及其他技术，还在异质外延半导体材料中构成了条形波导。定向耦合器型开关已有样品演示。此外，已制得侧向限制式单模波导激光器，可工作于长达  $1.6 \mu\text{m}$  的波长。