Electro-Optics:

Optical Fibers

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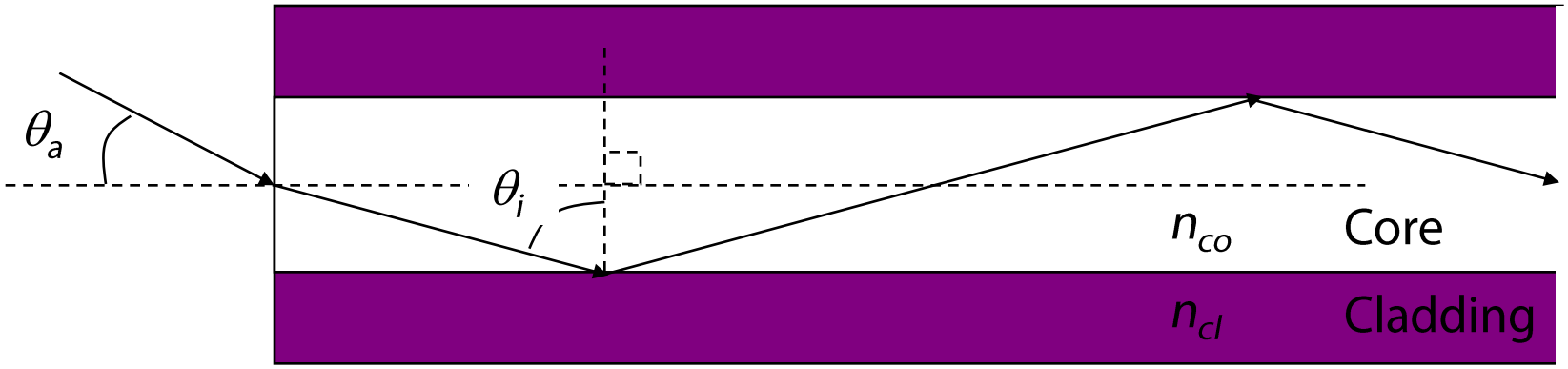
Optical Waveguides (1)



Total internal reflection:

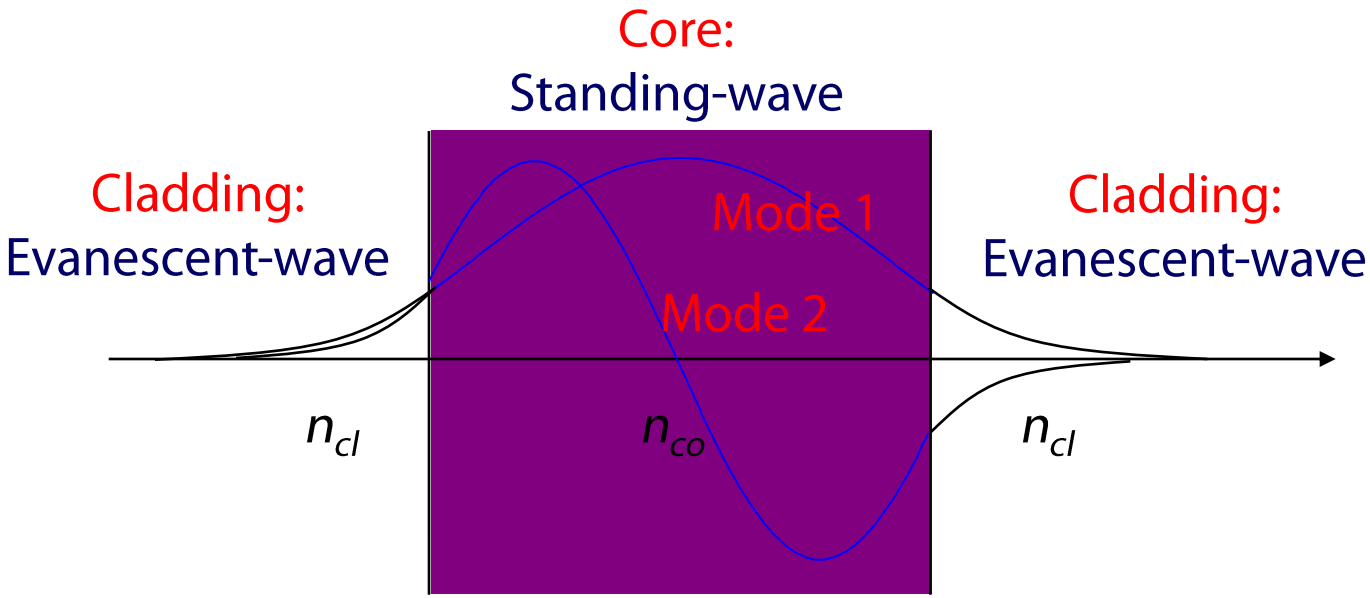
$$\theta_i > \theta_c = \sin^{-1}\left(\frac{n_{cl}}{n_{co}}\right)$$

Numerical aperture:

$$NA = n_o \sin\theta_a \approx \theta_a = \sqrt{n_{co}^2 - n_{cl}^2}$$

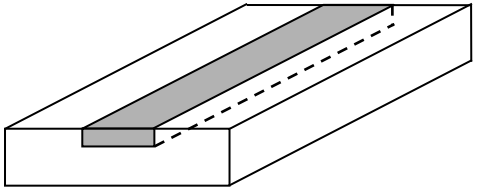
Optical Waveguides (2)

Quantized mode states:

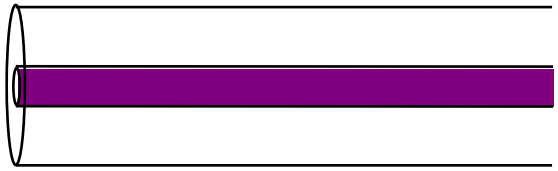


Planar W/G:

Channel W/G:



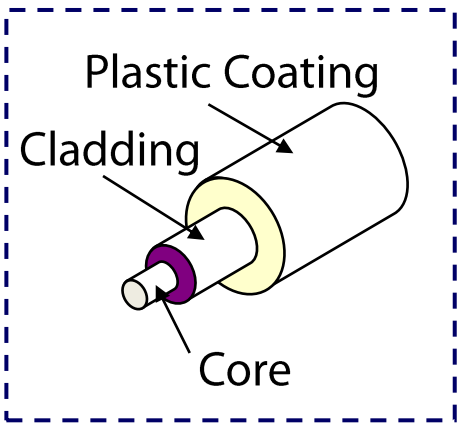
Circular W/G:



Optical Fibers

A flexible optically transparent fiber, as of glass or plastic, through which light can be transmitted by successive internal reflection

Structure of Optical Fiber:



Various Optical Fibers

Step-index multimode fiber (MMF)

Graded-index multimode fiber (GRIN MMF)

Single-mode fiber (SMF)

Dispersion-compensation Fiber (DCF)

Fabrication of Optical Fibers

Double crucible:

→ Direct drawing

Rod in tube:

→ Preform and drawing

Fabrication of Fiber Preforms

Deposition techniques:

Modified chemical vapor deposition (MCVD)

Plasma-enhanced modified chemical vapor deposition (PMCVD)

Outside vapor deposition (OVD)

Axial vapor deposition (AVD)

Preform Fabrication by MCVD

MCVD: Modified chemical vapor deposition

Dopants: GeO_2, P_2O_5, $ErCl_3$, Nd_2O_3

Fiber Drawing and Spooling

Procedure:

Drawing from preform

Quality checking

Coating for protection

Spooling