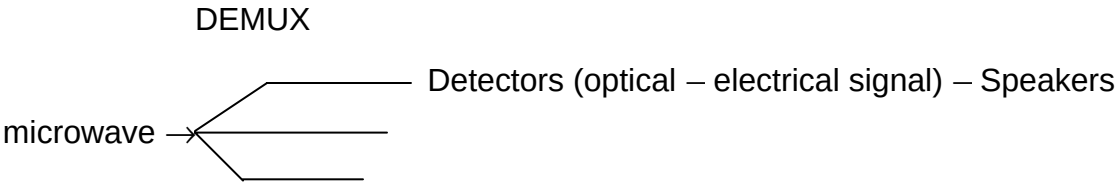
3.46 Photonics Materials and Devices

Design Review 4 (DR4): UHF (Microwave) AM Satellite Radio

May 15, 2006

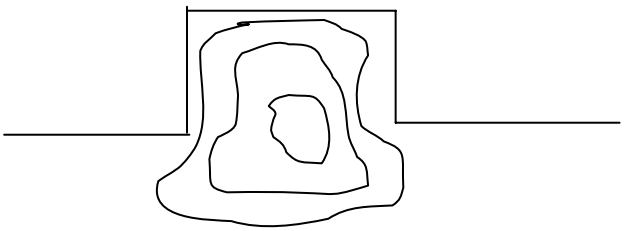
Reading materials:
"Fundamentals of Photonics" (pg. 900) on analog communication systems
Class lectures "Microphotonics 1 & 2"



Waveguide design

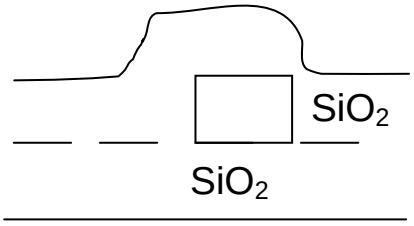
1. Size: 2 cm × 2 cm chip
   Waveguide material: SiON (~high n, low cost, low bending radius, small footprint)
2. Cladding: SiO_2
   Platform: Si wafer
   Use ridge waveguide or channel/strip waveguide

Ridge WG



- Low confinement
- Large turn radius
- Simple lithography
- Easy coupling to fiber

Channel WG



Si wafer

- Good confinement
- Better for planar integration
- If use Si for core, amorphous/poly is lossy (a-Si absorption will be too much:
  dangling bonds density: $N \sim 10^{17}$ cm^{-3},
  $\sigma \sim 10^{-17}$ cm^2,
  $\alpha = N\sigma \sim 1$ $cm^{-1} \sim 4$ dB/cm
- If use Si SOI wafers, wafer bonding, SIMOX, Smartcut

- Want single mode waveguide behavior, TE is the optimal for designing

In summary, things to consider for waveguide design:

- Materials and dimensions
- Cladding
- Mode
- Performance, loss, dispersion (not important for short distance), coupling

Proposed Design: