

## CHAPTER 15

### ELECTRONIC SCIENCE

#### Doctoral Theses

086. DHARMENDRA KUMAR  
**Optimization of Multilayer Metal Clad Optical Waveguide for Intergrated Optics.**  
Supervisors : Prof. K N Tripathi and Dr. V K Sharma  
Th 14209

#### *Abstract*

Represents the Optimization of various parameters for multilayer metal clad optical waveguide including buffer layer index, buffer layer thickness, type of metal and its thickness which strongly affect the attenuation of these waveguides. The attenuation characteristics of a multilayer metal-clad polymeric optical waveguides are examined by exact numerical method. Since, polymers have low cost and ease of fabrication (index can be tailored), waveguide and buffer as polymer materials are chosen for study. The result obtained can be used to fabricate all polymeric high performance TE pass optical waveguide polarizer. It shown that to design an efficient polarizer, thin finite metal films can produce better extinction ratio  $\alpha_{TM}/\alpha_{TE}$ . The studied waveguide structure can also be used for designing an absorption modulator by using buffer layer of electro optic material in which sufficient extinction ratio can be obtained by small change in the refractive index different between the buffer and the waveguide. Designing of a TM absorption polarizer is presented. For TM waves there is a resonant absorption peak for certain value of buffer layer thickness. Also the attenuation can be enhanced if the thickness of the metal layer is considered. This is caused by coupling from a normal guided mode to a lossy surface plasmon wave. Another way to realize such a polarizer is to use a superstrate dielectric layer on to the metal layer. For the optimum value of thickness of buffer, metal and superstrate, a TM absorption loss can be enhanced. This is because of the coupling of a slab waveguide mode to symmetric surface plasmon wave. Since these polarizers require thin metal films, low cost more efficient polarizers can be fabricated.

*Contents*

1. Introduction. 2. Optical Waveguides Theory, Optimization, Fabrication and Characterization Techniques. 3. Metal Clad Optical Waveguide with Low Index Buffer. Long Range Surface Plasmons for Integrated Optic Polarizers. 5. Frequency Response of Metal Clad Waveguide. 6. Periodic Coupling Effect in Multilayer Metal Clad Waveguides with High Index Buffer. 7. Conclusion. Bibliography

087. RAJESH KUMAR  
**Optimization of Optical Parameters in Polymeric Waveguides for Integration Friendly Platform.**  
 Supervisor : Prof. K. N. Tripathi  
 Th 14211

*Abstract*

The present work reported the Optimization of Optical parameters in Polymeric Waveguides using three different methods namely ageing and annealing, dye doping and multilayer structures.

*Contents*

1. Introduction. 2. Theoretical and Experimental Methods in Polymeric Waveguides. 3. Aging, Annealing and Solvents Effect in Polymer Waveguides. 4. Effect of Dye Doping in PVA and Polyurethane Waveguides. 5. Consistency and Variations in Optical Characteristics of Four Layer Polymeric Waveguides. 6. Conlucsion. Bibliography.

088. RAVINDER KAUR  
**Transparent and Conducting SOL-GEL Derived Yttrium Doped ZnO Films.**  
 Supervisor : Prof. R. M. Mehta  
 Th 14208

*Abstract*

The aim was to develop and characterize highly transparent and conducting yttrium doped n-type ZnO films by sol-gel process. The salient features of the study are : In case of ethanol as a solvent, DEA acts as one of the best stabilizer giving high quality films. The optimized deposition parameters for these films are; annealing temperature : 450°C, annealing time : 1 hr, annealing ambient : air and Y concentration : 3

wt%; The spin coated YZO films obtained using the optimized parameters exhibited a sheet resistance of  $120 \Omega/\square$  and an average transmittance of  $\sim 84\%$  for a thickness of  $\sim 500\text{nm}$ ; Changing the solvent from ethanol to methanol, the optimized annealing temperature becomes  $550^\circ\text{C}$ . The textured films suitable for solar cell windows were obtained in films with thickness  $\sim 0.8$  to  $2.0\mu\text{m}$ . Such films would find application as solar cell window material; The change substrate from corning glass to c-Si resulted in the observation of green photoluminescence from the nano sized ZnO particles. The ZnO/Si structure finds its use in fabrication of photodiodes and solar cells.

#### *Contents*

1. Introduction. 2. Sol-Gel Process, Deposition, Characterization and Measurement Techniques. 3. High Quality YZO Films : Role of Sol-gel Stabilizers. 4. Structural, Electrical and Optical Properties : Optimization of Physical Parameters. 5. Physical Properties of Natively Textured ZnO Films by Sol-gel. 6. ZnO Films on Silicon Substrate. 7. Conclusion. Bibliography.

089. YADAV (Sushila Kumari)  
**Parametric Instabilities in Laser Produced Plasmas.**  
 Supervisor : Dr. V. L. Gupta  
 Th 14210

#### *Abstract*

The work is related to parametric instabilities in laser-produced plasma. The development of intense short pulse laser has allowed exploration of new regime of laser and plasma interaction. The propagation of intense laser pulses in gases and plasmas is relevant to a wide range of applications, including laser-driven accelerators, laser-plasma channeling, harmonic generation, super-continuum generation, X-ray lasers, and laser-fusion schemes.

#### *Contents*

1. Introduction. 2. Stimulated Brillouin Scattering of a Laser in a High-Z Plasma Channel Embedded with Light Ions. 3. Oscillating Two Stream Instability of a Laser in a Two Ion Species Plasma. 4. Stimulated Brillouin Scattering at the Second Harmonic of a Laser in Two-Ion Species Plasma. 5. Second Harmonic Stimulated Compton Scattering of Laser in a Plasma. 6. Stimulated Raman Scattering of a Relativistic Laser Pulse in a Plasma. 7. Conclusion. Bibliography.