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Post-Doctoral Research: From 21-07-2007 to c 20-01-2008 – Liverpool University – England

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SUMMARY

Ion exchange of soda-lime glass substrates is well known as a Simple method of forming optical planar waveguides. The increase in surface refractive index, and hence the effective indices of the guided modes depend upon the ion exchanged with the sodium in the glass. Waveguides with two different effective modal indices for the fundamental mode are required to form thin homogeneous lenses, and ion-exchanged waveguides of the two types formed on the same substrate could be suitble for this purpose.

During the course of experiments into the production of both types of waveguides, we have experimented with a double exchange, into the same microscope slide substrate. The waveguides resulting from the two exchanges depended strongly on how the silver exchange took place.

We have used the silver exchange to provide a simple masking process, where a single negative film mask allows the formation of low effective single-mode waveguide over parts of the the formation of low effective single-mode waveguide over parts of the substrate, and high effectve index multimode waveguide over the remainder. An evaporated aluminium mask is first formed on the substrate, the negative mask is dissolved away, and the substrate placed in a dilute melt of silver nitrate in sodium nitrate at certain concentration, temperature, and time, the parts of the substrate preventing exchange, where there is a layer of aluminium. The layer of aluminium is then removed, and the substrate placed in the same previous solution at certain temperature and time also. We have this

method to realize n integrated-optic demultiplexer using a type of diffraction gratings known Michelson's echelon grating to separate different wavelengths laser beams. The theoretical performance is given for the proposed optical demultiplexer. The intinsity at the output of the grating and the angle of diffraction for both beams and hence, the angle between them are calculated at different incident angles. The resolution and the resolving powere of the demultiplexer re determined. The description of the experimental steps to realize the demultiplexer is given. The characteristics of the waveguides and components of the practical model are given. The practical results are compared with the calculated ones.

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