It can be difficult to optimise the structure and operating point of gain levers for all-round performance; however, the calculated static light–current curves of Fig. 3 ($k = 0.85$) are fairly typical, the general shape applying to most devices. The best link loss and noise figure are generally obtained close to point 'A' (indicated by the maximum separation of the plots at constant $i_{2}$), however, bistability and hysteresis are also evident in this region. In Fig. 4 we show the dependence of the enhancement in modulation efficiency (over that with both contacts shorted) at 1 GHz, on the DC bias $i_{1}$. The current $i_{2}$ was adjusted to maintain a constant optical output power. As expected from Fig. 3, the maximum modulation enhancement occurs close to $i_{2} \approx 0$ mA. Also shown in Fig. 4 is the commensurate degradation in the TOI which is worst for $i_{1} \approx 0$ mA. This general trend is observed for different values of $h$ and may be understood as resulting from the fact that the region of greatest modulation enhancement is also the region of greatest change in enhancement, and hence of greatest non-linearity.

These simulations demonstrate that, although gain levers are attractive for reducing SCM link loss and noise figures, in this configuration at least, reduced noise figure is obtained at the expense of dynamic range.

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References


716

VERY LOW LOSS ION IMPLANTED PLANAR WAVEGUIDES IN LEAD GERMANATE GLASS

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Indexing terms: Ion implantation, Optical waveguides, Glass

Ion implantation has been used to produce very low loss optical waveguides in lead germanate glass samples. There is an increase in the refractive index of 0.35% for the given ion beam parameters. The loss can be as low as 0.15 dB/cm after thermal annealing.

Introduction: Ion implantation has been used to form waveguides in many different insulators (especially crystalline insulators) [1]. The variety of different substrates and applications have made ion implantation a widely accepted technique. Losses of $\sim$1 dB/cm, which are reasonably good for many applications, have made ion implantation competitive with other techniques, except where extremely low losses $<0.1$ dB/cm are required.

An essential step toward lower losses using ion implantation is the production of a very low loss planar waveguide in a lead germanate glass substrate. The loss in this waveguide is $\sim$0.15 dB/cm, which is the lowest yet reported using H$^{+}$ ion implantation and is comparable with the best from other techniques.

Results and discussion: The waveguides used for the experiments were implanted with H$^{+}$ and He$^{+}$ at 77 K. The
implanted guide was lower for most of the annealing temperatures. The spot size of the focused laser beam is ~10 μm, which is larger than the 6.4 μm width of the waveguide, resulting in a launch efficiency of less than 10%. Nevertheless, assuming a 100% launch efficiency the loss, at 200°C for the 4He+ implant, is as low as 0.15 dB/cm. The lowest loss for the 4He+ implanted waveguide is 0.3 dB/cm after the 300°C annealing temperature. For both of the cases we can assume a reproducibility error of ±0.05 dB/cm. After it reaches its minimum value, for both waveguides, the loss increases due to destruction of the waveguide.

Conclusions: We have demonstrated the first example of an ion implanted waveguide in lead germanate glass. Furthermore, these guides have the lowest loss ever reported for He ion implanted waveguides in either glass or crystalline substrates. Further optimisation of the edge polishing and minimisation of the surface scattering should lead to even lower propagation losses. This should readily allow lower pumping thresholds and better waveguide laser performance for the rare earth doped lead germanate glass.

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References


INTERPOLATOR FILTER STRUCTURE FOR ASYNCHRONOUS TIMING RECOVERY LOOPS

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Indexing terms: Synchronisation, Digital signal processing

A novel structure for the interpolation filter used as a timing-correction element in asynchronous timing recovery loops is introduced. Multirate techniques are employed in an algorithm to institute both bulk and fractional delays in the loop. The performance of the new algorithm is illustrated by generation of the S curves for a two-point NDA tracker and a four-point DD tracker.

Introduction: The generic asynchronous timing-recovery loop is shown in Fig. 1. The input analogue waveform is sampled to give B samples per symbol although the phase of the sam-