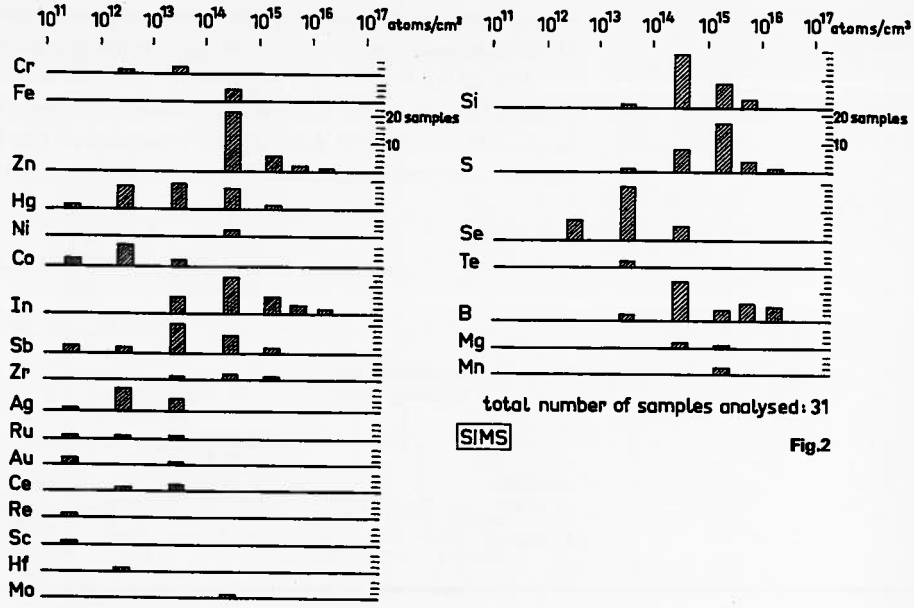



Fig.1 Fig.2

- persistent minor impurities which are always present but in very low concentrations: Hg, Ag, Co, Se;
- occasional contaminants (Fe, Zr, Cr, Ce, Au, Mo, Hf, Ni ...) usually in low concentrations.

From tests on Ga and As samples, the origin of almost all impurities can be traced: Hg, Sn, Fe, In, Ag, Cr, Co come from gallium, and Ni, Sb, Zn, Co, Cr, Ce, Ta come from arsenic. Only Zr cannot be attributed to any of the starting elements. A correlation has been found between B and Si contamination. Furthermore, the incorporation of these two elements is dependent on the water concentration of $B_2O_3$ encapsulant. It can be said, finally, that only sulphur and sometimes Si, B, Zn, In and Fe are found in GaAs crystals, in concentrations exceeding $1.10^{15}$ cm$^{-3}$. Apart from In and B, which can be considered as minor, none of the impurities exceeds a concentration of $1.10^{16}$ cm$^{-3}$ (note that $1.10^{16}$ cm$^{-3}$ = 0.25 ppma).

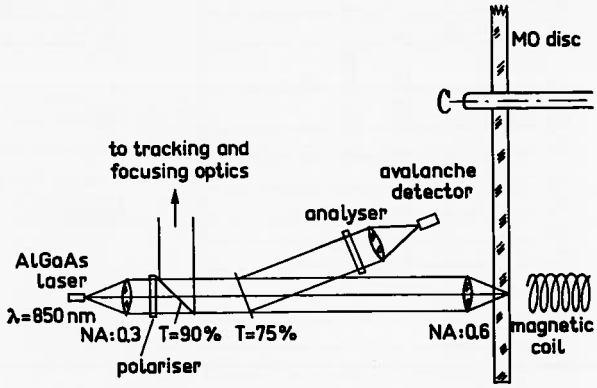
# Erasable digital magneto-optical recording on disc

An experimental digital disc recorder has been constructed at the Nat.Lab. The erasable recording medium consists of a disc with an amorphous magneto-optic alloy top layer, made at P.F.H. (see Newsletter 77, p.6). A diode laser is used for recording and reading the information.

The amorphous magneto-optic material used in the disc recorder designed by *J.J.M.Braat*, *K.A.Schouhamer Immink* and *R.M.Aarts*, has binary stable states of magnetization perpendicular to the disc plane. Compensation point writing is the method of recording. This writing technique involves heating the bit location (approximately 1 µm in diameter) with an AlGaAs laser to some 200 °C. A small external magnetic field (typically $10^4$ A/m) applied opposite to the direction of initial magnetization of the layer, determines the final magnetization of the heated spot

after cooling. Local erasure of the information is possible by reversing the direction of the external magnetic field and again heating the material with the pulsed laser.

Optical read-out of the recorded information is done in reflection using the Kerr effect. The Kerr effect in the kind of layers used amounts to a rotation of 0.5-1 degrees of the plane of polarization. This rotation can be analysed by illuminating the disc with linearly polarized light and transforming the Kerr rotation into an




intensity modulation with an analyser in front of the photo diode. Low-cost plastic sheet polarizers proved to have a sufficiently high extinction ratio for this application. The diagram shows the layout of the experimental set up. The most important design parameters of the system are given in the table below.

Fields of application are: archives, computer memories and consumer applications such as digital audio.

| | |
|---|---|
| Laser: | AlGaAs diode laser, 850 nm wavelength, 10-20 mW power on the disc in a 50 ns pulse. |
| Objective lens: | NA 0.6, half-width diameter of the spot 0.9 μm. |
| Polarizers: | NH7 Polaroid sheet. |
| Detector: | silicon avalanche photo detector. |
| Bit rate: | 2 Mbit/s. |
| Bit density: | 40 Mbit/cm$^2$. |
| Modulation system: | EFM (Compact Disc standard). |
| Typical bit error rate: | $< 10^{-4}$. |

# Statistical methods improve precision injection moulding

The statistical methods in the design of experiments can be used to enhance the dimensional accuracies of components made by injection moulding of plastics, as has been shown in a combined effort by the Nat.Lab. and Video. The inaccuracies in the dimensions of a 7mm-diameter bearing bush were stated beforehand to be ±20 μm. Preliminary adjustment of the production conditions reduced these to about ±10 μm. Statistically designed experiments using a relatively small number of process-parameter settings allowed inaccuracies to be reduced to ±2 μm. These last-named values made injection moulding of a spiral-groove bearing bush feasible.

Until recently, injection moulding of plastics was not a suitable way to produce spiral-groove bearing bushes with tight specifications on the cylindrical form (see table).