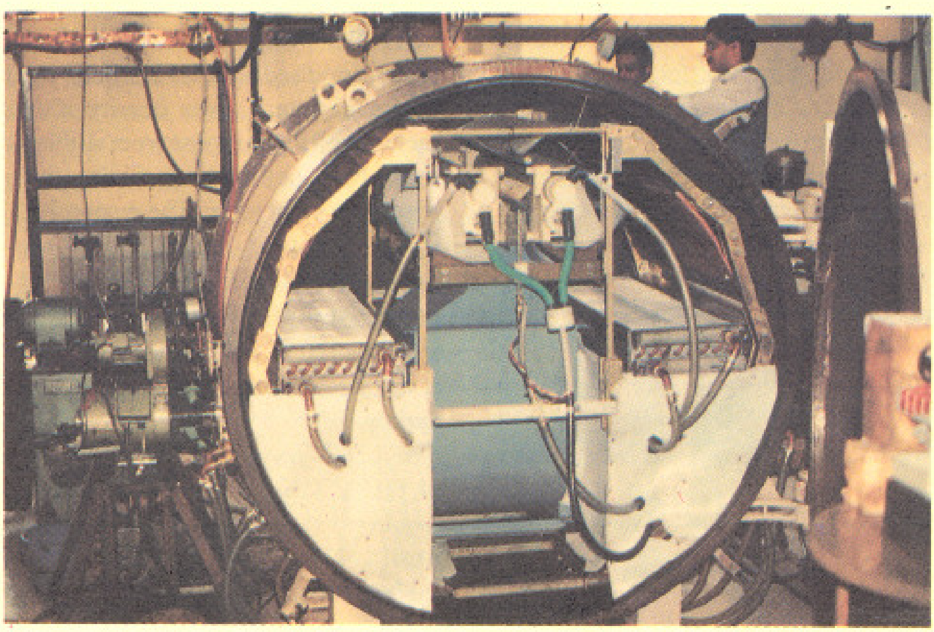
Newsletter

CENTRE FOR ADVANCED TECHNOLOGY

Year - 4 Dec. 1991



RESEARCH AND DEVELOPMENT

LASER PROGRAMME

2.5 kW CW CO_2 Laser

A transverse gas flow high power continuous wave (CW) CO_2 laser has been developed at CAT. While optimisation of the system is still in progress, the laser is already operating at a CW power of more than 2.5 kW in a beam of 30mm diameter and ~2 mrad divergence. The laser has also been used to cut mild steel sheets of up to 5mm thickness. The photograph on top shows the inside of the laser chamber. Details of the system are discussed in the article appearing in this issue.

High repetition rate N_2 Laser with fiber optic delivery system

A high repetition rate (100 Hz) Nitrogen laser with an average power of 2.5 mW and a fiber optic delivery system has been developed and installed at Choithram Hospital and Research Centre, Indore. It is being used for in-vivo studies on pulmonary tuberculosis and for studies on laser biostimulation.

The compact N_2 laser developed at CAT uses a ceramic-metal sealed-off spark gap as the switching element. A 15 kV, 200 W series resonant switched mode power supply operating at 50 kHz has been specially developed for this laser system. This results in negligible switching losses and also offers a considerable reduction in weight and volume. The laser cavity is only about 20 x 10 x 9 cm^3. A silica fiber having core diameter of 400 micrometer and a numerical aperture of ~0.2 has been used for laser-beam delivery.

A smart multi-bath temperature controller for crystal growth

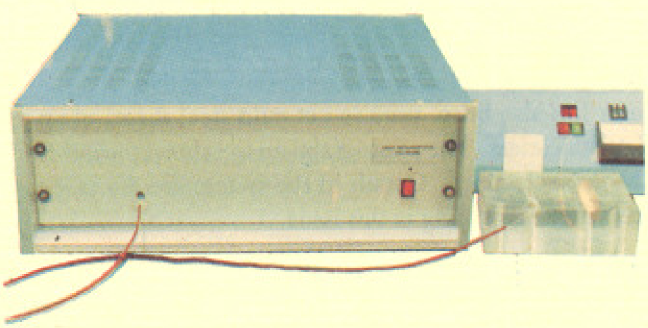
Growing single crystals from solution has the advantage of having a working temperature close to the ambient and thus reducing the probability of thermal shocks to the crystal during growth. However, for growing large defect-free crystals the method requires a tight control on temperature over the large growth volume. For this purpose, a microprocessor based instrument has been developed which controls the temperature of three water baths with capacity of about 100 liters each, within $\pm 0.02^{o}C$. The instrument can give the required cooling profile independently to each tank, ranging from 0.02 degree per day to more than 10 degrees per day. The system has been designed in such a way that it can also be used in the more complex "solution transfer" growth system, where three tanks are kept at slightly different steady temperatures. The instrument supports upto six stepper motors to be run in a stop/ reverse fashion, for rotating the seed crystals. Since this instrument is expected to run continuously for long durations, hardware watch-dog timer and data validation techniques were introduced to improve the reliability. High reading accuracy is achieved using semiconductor type temperature transducers and 4.5 digit analog to digital converters, and a high control accuracy is achieved by proportional integral control algorithm combined with pulse width modulated heater outputs.

Laser power meter

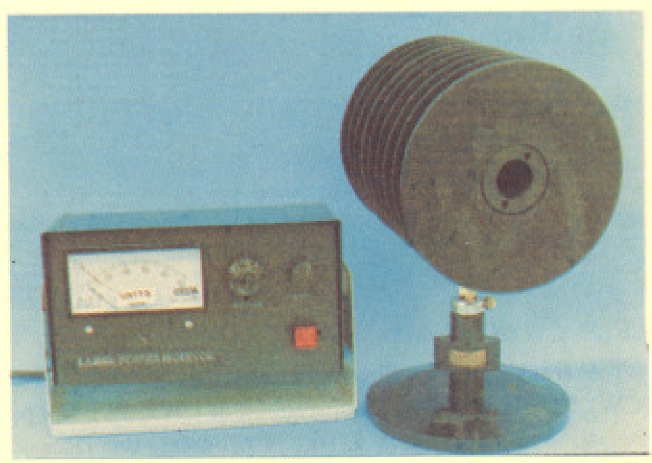
Subsequent to successful development of 30 W Laser power meter, prototype units capable of measuring CW power upto 100 W have now been developed.

The 100 W power meters, with design similar to the 30 W versions described in CAT Newsletter Dec 1990, have improved responsivity of 0.3 mV/W and a resolution of 10 mW. For power meters to be used with only CW CO_2 lasers, anodised alumina has been used as the absorber. It allows maximum power density of upto 1 kW/cm^2. Power meters with flat response from visible to IR region have also been developed by over-coating the active area with an absorbent paint layer. The responsivity measured at visible (Copper Vapour Laser) and 10 μm wavelengths were found to be within 3%. The paint however limits the average power density to 150 W/cm^2.

One 100 W power meter has already been supplied to a visiting scientist from Department of Atomic Energy, Syria.



N_2 laser with fiber optic beam delivery system.



100 W Laser power meter developed at CAT.