S.p.34. SATHEESH KUMAR, M.K.–Title of the thesis: Photoacoustic effect: Some applications in laser technology –1988–Dr. C.P. Girijavallabhan

The thesis presents a detailed account of the investigation carried out in the area of Photoacoustic (PA) technique and an extensive version of its instrumentation. It contains many examples in which simple measuring techniques based on PA

effect have been effectively utilised for different types of studies associated with laser technology. One of the important work presented is the design and fabrication of a laser power meter based on PA effect. This laser power meter is capable of detecting all wavelengths from near ultraviolet to far infared region. Subsequently a measuring range from 5 w to 10 w is obtained which represents a considerable improvement over similar devices reported earlier. This set up has been successfully employed in the laser attenuation measurement in the atmosphere using a He-Ne laser. From the result it is found that the pollution is maximum at 2 am in Cochin University campus.

Similarly PA studies have been extended to study the thermal diffusivity of Copper and CeO_2 films for different thicknesses and this method offers a promising tool for the precise measurement of thermal parameters of such samples. These studies in fact revealed the possibility of identifying the thermal parameters associated with dielectric materials which are needed for the development of high quality optical materials for laser systems.

A current stabilised CW CO_2 laser has been designed and fabricated. It essentially consists of two wafer cooled plasma tubes of lengths 75 cm each are optically in series but electrically in parallel. Solid state circuitry is employed for current stabilisation and control. Stabilised CW laser beam in the 10.6 m region upto 30 Watts is available from this system. Parametric studies of the current regulated CW CO_2 laser have been carried out using a potoacoustic laser power meter. The detailed study of variation of laser power with plasma tube current levels at a fixed gas pressure gives the parametes for optimising the operating conditions. It is found that the additon of water vapour at 0.3 torr improves the power level beyond 30 W.

This CO_2 laser has been successfully employed for material processing in silicon wafers. The optical transmission through this wafer is measured as a function of time using the photoacoustic laser power meter. It is observed that the transmission coefficient decreases with the time and in 10-15 seconds it reaches a steady value. Thus the absorption coefficient could be determined at this temperature from which the free carrier concentration in an intrinsic semiconductor is accurately calculated.