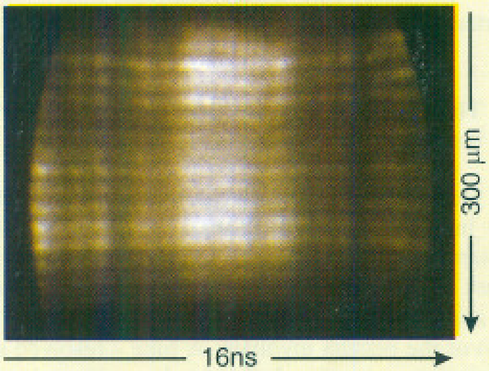
Straight-line fringes are observed when the probe beam does not encounter any plasma in its path. Analysis of the shifted fringe pattern is being carried out to derive the time resolved electron density profiles of the plasma.

Without plasma



With aluminum plasma

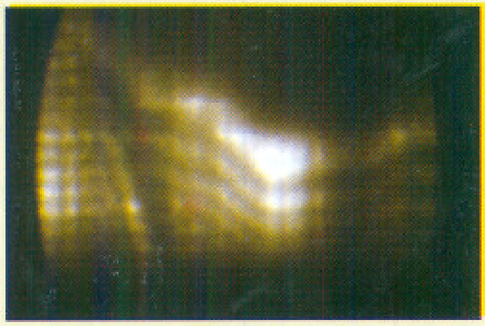


Fig. L.8.2 Interference fringe pattern

(Reported by: P. D. Gupta; pdgupta@cat.ernet.in

L.9 ZnO quantum dots grown by pulsed laser deposition

ZnO is a versatile wide band-gap semiconductor having intrinsically high n-type conductivity. Its bulk band-gap is about 3.3eV at room temperature and therefore it is transparent in the visible region. Because of this interesting blend of properties it finds applications as transparent conducting electrodes for solar cells, surface acoustic wave devices, UV screens, gas sensors etc. ZnO is particularly attractive for applications in nuclear environments because it is radiation hard.

To develop the next generation ZnO based devices where size and band-gap engineering are prerequisites, it is advantageous to grow the quantum dots of this compound. We have grown, to the best of our knowledge for the first time, a multilayer structure of ZnO quantum dots capped by the separator layers of alumina using an in-house developed methodology of Pulsed Laser Deposition. Using optical absorption spectroscopy, the band edge of the quantum dots ensemble was found to shift from about 3.35 to 4.5eV when the mean in-plane size was decreased from about 3.6 to 1.8nm. The mean dot size and the size distribution were measured using Transmission Electron Microscope. The chemical composition of the dots was confirmed by selective area electron diffraction pattern. This opens up the possibility of developing ZnO quantum dot devices such as oxygen sensors, laser diodes etc.

(Reported by: L M Kukreja; kukreja@cat.ernet.in)

L.10 Development of IGBT based pulse power supply for copper vapor laser

Insulated gate bipolar transistor (IGBT) based pulse power supply for 30W average power copper vapor laser has been developed. This power supply will replace conventional thyratron based power supply. In conventional thyratron based power supply, hydrogen thyratron is used as the high voltage, high power and fast switch. The hydrogen thyratron has typical life of 1200 hours, after which the thyratron has to be replaced. The thyratron is imported and costly component and is subjected to export restrictions from the country of origin. The IGBT based power supply uses industry standard IGBTs (EUPEC BSM400GA120 DN2) rated for 1200V, 400A and magnetic pulse compressors. A step up pulse transformer is used to change the voltage level from 1kV to 22kV. The IGBTs have much longer MTBF as compared to the thyratron and thus operating expenses of the copper vapor laser system due to switch will reduce substantially (see Table L.10.2). The IGBT based power supplies have given the same laser output power from the corresponding laser head as that of the conventional power supplies.

Table L.10.1. Comparison of conventional and IGBT based power supply.

Sr. No	Pulse Power supply circuit	Main Switch cost Rs.	Estimated Switch life time	Estimated running cost due to switch
1	Thyratron based	2,50,000	1200hrs	Rs 208 per hour
2	IGBT based	30,000	250000hrs	Rs. 0.12 per hour

(Reported by: S. V. Nakhe; nakhe@cat.ernet.in)