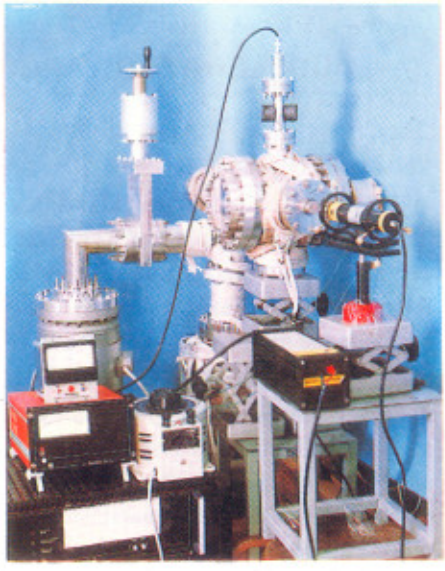
power was varied from 5 to 160 Watts. The maximum current obtained for argon-and helium ions was 2.5 mA at 4 kV and 1.5 mA at 1 kV respectively. The axial magnetic field was varied from 0 to 100 Gauss. Such an ion source will also be used for injection into the proton linac using hydrogen gas plasma.

Synchrotron radiation beam viewer

In a synchrotron radiation (SR) beam line, a beam viewer is an important module to carry out beam alignment after every optical element. A beam viewer comprising a novel electromagnetically operated flipping mechanism has been designed and developed for operation in an ultrahigh vacuum chamber. The flipping mechanism rotates a fluorescent screen by 45° to bring it in the path of the synchrotron radiation beam. The beam position is then monitored using a closed circuit TV camera placed at right angle to the SR beam path.

The flipping mechanism, driven by an electromagnetic actuator, consists of a stainless steel cantilever rod which is rotated by a plunger made of a soft magnetic material. This plunger moves in a stainless steel cylinder because of the electromagnetic force induced by an induction coil placed concentric with the stainless steel cylinder. The magnetic force pulls the plunger in such a way that the fluorescent screen makes an angle of 45° through mechanical limiting of its motion. The actuator along with the screen is mounted on a standard conflat flange which is fixed on to the beam viewer chamber. The beam viewer has been tested down to a vacuum of 8×10^{-9} mbar.



Synchrotron radiation beam-viewer with electromagnetic actuator.

Compact Faraday cups

The most widely used device for measuring electron or ion beam currents is the Faraday cup, which stops the beam completely. Compact water-cooled Faraday cups have been fabricated to measure the pulsed electron beam currents from a linac electron gun. A 40 kV, 100 mA, 2.6 μsec pulsed beam at 1 Hz corresponds to a power dissipation of a few milliwatts only. Pulsed currents were measured using a toroidal current transformer. The number of turns and the load resistance were matched to get a 1 mV signal for 1 mA beam current without affecting the time structure of the beam. In addition, high power water cooled Faraday cups have also been developed, and tested with a continuous beam of 2 kW power from a high voltage, high current electron gun (60 kV, 30 mA). Effects arising from sputtering, space charge, secondary particles and contact potentials have been taken into account during the design. A batch of three Faraday cups have been designed, fabricated and tested for electron beams in both pulsed and continuous modes.

Dynamic balancing machine setup for turbo-molecular pumps

A turbo-molecular pump is an efficient device for creating ultrahigh vacuum of the order of 10^{-9} mbar. CAT has taken up the development of a 150 litre/sec capacity turbo-molecular pumps.

The critical areas of the development of a turbo-molecular pump are mainly the fabrication of a complex geometry multistage finned rotor, stator, a three phase electric motor, a variable frequency power supply and the precision dynamic balancing of all the rotating components upto the operating speed of 50,000 rpm. A dynamic balancing machine satisfying our specifications has been developed for the first time in India by a private balancing machine manufacturer. The machine has been accepted and commissioned at CAT.

The set-up consists of two balancing machine modules. The first is a hard bearing type of balancing machine which will be utilized for low speed component balancing of various components such as motor rotor and the pump rotor separately. At low speed balancing the gross unbalance which is usually introduced by the size variation and machining tolerances, is minimised. The components are balanced upto a maximum of 6,000 rpm

High-speed-assembly balancing machine for turbomolecular pump.

and an unbalance of the order of 0.001 gram-mm can be achieved. The second module is a soft bearing assembly balancing machine utilized for high speed balancing of the complete assembly of the pump which is run under a simulated condition. The balancing is achieved by applying the required mass correction and controlling the vibration levels at various speeds upto an operating speed of 50,000 rpm. A vibration level of 0.1 mm/sec has been achieved at the operating speed of the turbo-molecular pump after assembly balancing.

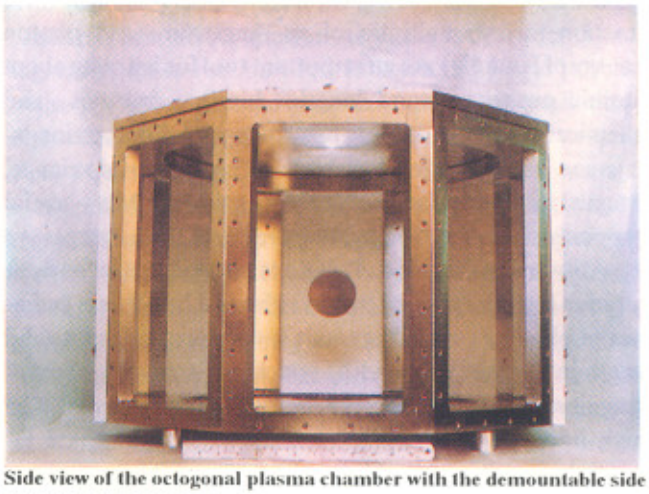
Photoluminescent porous silicon: fabrication and characterization

Porous silicon has been fabricated by electrochemical anodizing of single crystal silicon wafers. The morphology of the porous layers depends on several factors such as anodic or cathodic over potential, electrolyte composition, dopant concentration, and ambient light conditions. Though single cell approach for fabrication is simpler than the two cell approach, it produces non-uniform porous layers. The current density during the experiments is kept below the electropolishing range. We have standardized a procedure of fabrication of photoluminescent porous silicon with the two cell approach. The characterization of porous silicon has been done by photoluminescence measurement using the UV radiation from a nitrogen laser, and by electron microscopy. The photoluminescence peak is near 600 nm and has full-width at half-maximum (FWHM) of about 140 nm. The peak of photoluminescence corresponds to a bandgap more than 2.0 eV, which is far above the bandgap of single crystal silicon. The photoluminescence is stable and does not degrade on exposure to atmospheric conditions. Scanning electron microscopy of photoluminescent porous silicon reveals that the silicon column sizes are about one micron and the porous layers have uniform porosity (cover photograph). Transmission electron microscopy shows sharp electron diffraction patterns and does not show the presence of an amorphous phase in porous silicon.

INFRASTRUCTURAL DEVELOPMENT

Octogonal plasma chamber

The workshop has designed and fabricated a large octogonal plasma chamber to study laser plasma in the VUV and X-ray region. The SS chamber of height 48 cm and octogonal face to face distance of 70 cm has demountable side flanges on all the eight sides as well as on the top. This enables easy installation of various diagonostic devices. The chamber has been leak tested to $1x10^{-8}$ std. cc/sec (helium) and a vacuum of $2x10^{-5}$ mbar has been obtained during vacuum testing.



Side view of the octogonal plasma chamber with the demountable side flanges partly removed.

Afforestation activity at CAT

Horticulture section has taken up a large afforestation programme in CAT since last year with a plan to plant about 28,000 trees during the eighth five year plan. About 7000 trees have been already planted during 1992-93 and work has started this year to plant about 10,000 trees.

Dr D D Bhawalkar, Director, CAT planting a sapling (right) as part of the afforestation programme at CAT on 21.7.93.

Computer facility

A supermini computer based on a RISC R-3000 processor has been commissioned for scientific computing purpose. A network-based telex software, which enables users to send telex messages using CATNET, has been developed.