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.

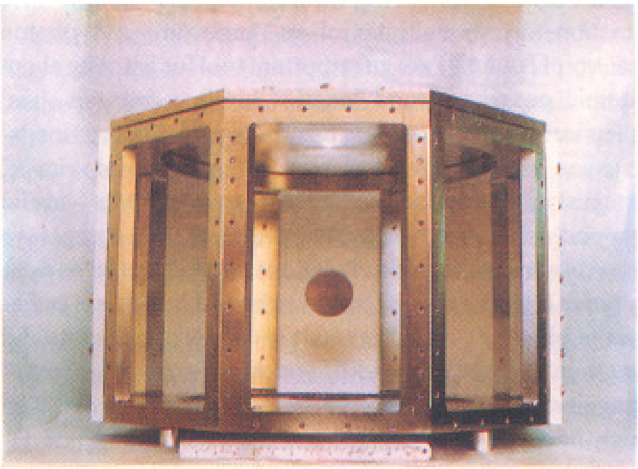
Photoluminescent porous silicon: fabrication and characterization

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 1×10^{-8} std. cc/sec (helium) and a vacuum of 2×10^{-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.

Construction activity

Construction work of the Laser R&D blocks A,B & C and of the Accelerator Support Technology Building is nearly over. Construction work of the canteen building and an overhead water tank with distribution lines etc. is in an advanced stage of completion. Central A/C plant has been commissioned. Two sump wells, each of four lakhs litres capacity, have been put into operation.

All the 399 houses of various categories sanctioned under the seventh plan have been completed. Construction of 162 houses out of the 184 houses sanctioned under the eighth plan is in progress.

Synchrotron Radiation Source INDUS - 2: Design Features

Charged particles emit electromagnetic radiation when they are accelerated, and thus this radiation is observed when electrons are forced to follow a curved path in a magnetic field. In synchrotrons and storage rings, electron bunches at relativistic energies are forced to traverse curved paths by the bending magnets. The radiation emitted during bending, referred to as synchrotron radiation, has several important characteristics including high intensity, broad spectral range, natural collimation, high polarization, pulsed time structure and small source size. Any or a combination of these properties makes synchrotron radiation an important scientific tool for a wide variety of scientific and technological applications.

A synchrotron radiation source (now also simply called synchrotron source) is an electron storage ring designed and operated specifically for the production of synchrotron radiation. However, the first generation sources were high energy particle accelerators built for particle physics studies on which synchrotron radiation users were considered parasites. The second generation sources are electron storage rings such as SOR (Japan), SRS (UK) and NSLS (USA) built specifically for production of synchrotron radiation. In these rings which are presently operational and also extensively used, the major sources of radiation are bending magnets. The radiation from a bending magnet has a continuous spectrum with wavelengths ranging from infrared to x-rays. (This spectrum is characterized by a wavelength called critical wavelength. In the power spectrum, half of radiation power is emitted below this wavelength and half above this wavelength.) The third generation sources are more powerful sources in which radiation also comes from insertion devices. Several such sources are presently under construction and some including SUPERACO (France), ALS (USA) and ESRF (France) are already operational. The insertion devices used in these sources are wigglers and undulators. Both of these devices provide transverse alternating magnetic field along the straight path of electrons which cause them to periodically accelerate inwards and outwards giving rise to a series of local radiation sources. The radiation produced from wigglers have characteristics similar to bending magnet radiation with the difference that the spectrum of radiation is shifted and the intensity is enhanced in proportion to the number of poles. In undulators, electrons undergo feeble deflections; the radiation from these have sharp peaks at certain wavelengths. The intensity of the radiation at these wavelengths becomes much higher and increases as the square of the number of undulator periods. In VUV and x-ray range, second and third generation sources are much more powerful compared to conventional sources.

The Centre for Advanced Technology (CAT) is constructing two synchrotron radiation sources; INDUS-1, a 450 MeV electron storage ring for VUV radiation and INDUS-2, a 2 GeV storage ring for x-rays. The design of INDUS-1 has been discussed in the December 1988 issue of the CAT Newsletter. Presently, INDUS-1 is in an advanced stage of construction, and the construction of INDUS-2 will start soon. In this article, our objective is to discuss basic design features of INDUS-2 including the characteristics of x-rays which will be available from this source. In order that a reader is able to appreciate the capabilities of such a source, a brief description of some applications of x-rays from synchrotron radiation sources is given.

X-rays, because of having wavelengths ranging from a fraction to few multiples of an Angstrom (and photon energy of few keV) are an important tool for learning about atomic positions, bond lengths, binding energies and chemical composition. For providing such information, x-rays are used in several disciplines e.g. material science, chemistry, molecular biology and geology. Most useful properties of x-rays from synchrotron radiation sources are intensity or flux (number of photons emitted per second per mrad in a given spectral bandwidth) and brightness (number of photons emitted per unit source area per unit solid angle in a given bandwidth) which are several orders of magnitude higher than conventional x-ray sources. The high intensity enables experiments to be performed incredibly rapidly, while high brightness enables study of extremely small samples with a high spectral or energy