Newsletter

CENTRE FOR ADVANCED TECHNOLOGY

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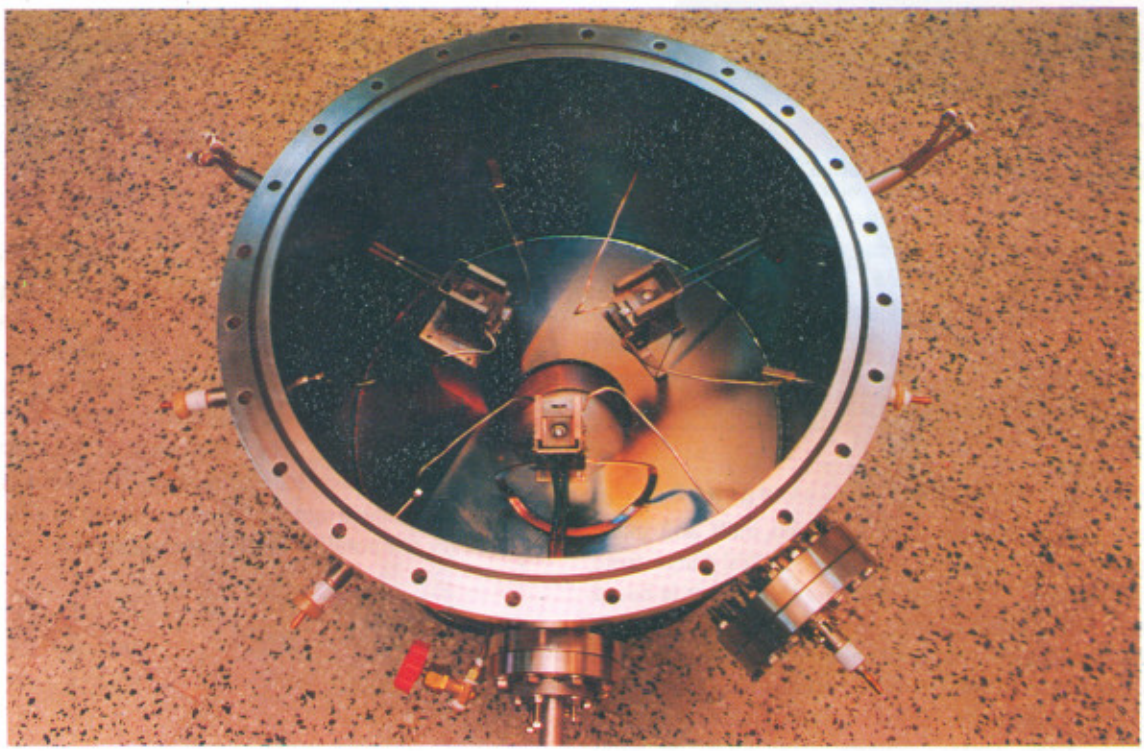
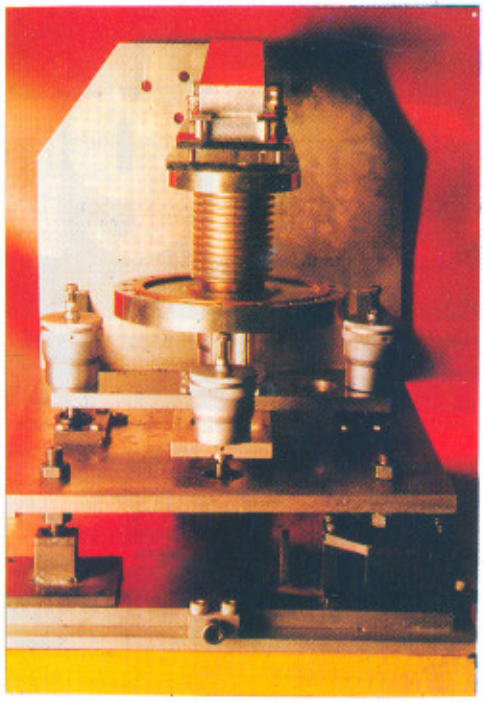


RESEARCH AND DEVELOPMENT

ACCELERATOR PROGRAMME

Mirror Movement Mechanism

In synchrotron radiation (SR) beam line, pre- and post-mirrors are important optical elements for precisely focusing SR on a monochromator and on the target in an experimental station. These mirrors are mounted in ultra high vacuum (UHV) chamber and require a mechanism which can provide precision six degrees of freedom, i.e. rotational motions about x, y & z axis in the range of 0 to ± 1 degree with a resolution of 10 seconds, and three linear motions in the range of 0 to ± 10 mm with a resolution of 10 microns. For this purpose, a novel mirror movement mechanism has been developed. Two rotational motions about x & y axis have been provided to the mirror by a constrained kinematic chain consisting of four higher and four lower pairs. These motions are transferred from atmospheric pressure to vacuum by a pipe and a hydroform bellow. Third rotational motion about z axis has been performed by a UHV linear motion feed through. The other three linear motions have been provided by precision screws. This mirror movement mechanism has been tested on a long focal length autocollimator and results are found satisfactory. The mirror movement mechanism has been assembled with pre mirror box and a dummy mirror inside the vacuum chamber which has been aligned at 4.5^0



Mirror movement mechanism for synchrotron radiation mirror box.

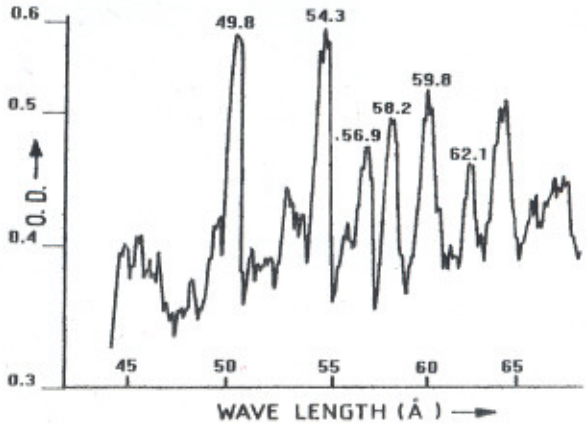
30" with respect to beam path. This system is at present under vacuum testing.

LASER PROGRAMME

Flat Field Grating XUV Spectrograph

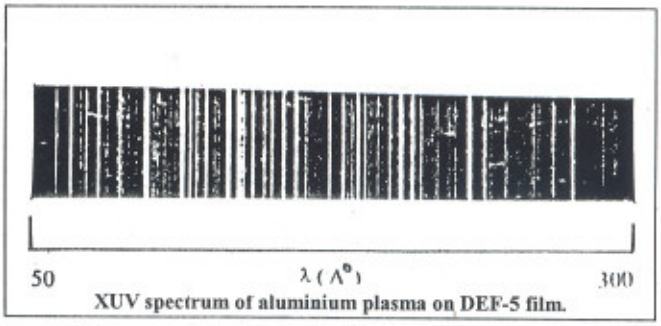
A flat field grating spectrograph has been built and made operational. The spectrograph covers a spectral range from 30 Å to 300 Å in the XUV region. This instrument is based on a variable line spacing grating which focuses the spectrum in a plane unlike the conventional spectrographs which focus the diffracted spectrum on a Rowland circle. This unique flat field focusing makes this spectrograph usable with fast devices like x-ray streak camera (for high temporal resolution) or detectors like micro channel plate (MCP) detectors (for on-line measurements) which have a flat input plane.

The spectrograph consists of a Hitachi make concave reflection grating of size 50 mm x 30 mm with a radius of curvature of 5.6 meters. It has a groove spacing varying from 0.69 μm to 0.99 μm (average 0.83 μm corresponding to 1200 lines/mm) from one end to another within the ruled width of 49 mm. XUV films like Kodak DEF-5, UShF4, Kodak 101 etc. are used for recording the spectrum. A 50 mm x 35 mm piece of the film is loaded in a cassette, which is mounted on a stepper motor controlled translation stage. This takes three



Densitometric trace of the spectrum between 45-65

different exposures (8 mm wide) on the same film. A gate valve is provided to maintain vacuum in the plasma chamber while loading/ unloading the film. Performance of the spectrograph has been tested using XUV radiation from plasma produced using 3 J, 28 ns pulses from a Nd:Phosphate glass laser chain. For this purpose, the laser beam was focused on planar targets (Be, C, Mg, Al, Si etc.) using a 400 mm focal length convex lens. The target was kept in a chamber evacuated to 5×10^{-5} torr. Spectrum of Al plasma recorded on a Kodak DEF-5 film is shown in Figure below. The densitometric trace in the wavelength region of 45-65 of the same spectrum is also shown in Figure above. The lines in this range are identified to belong to Al^{+7}, Al^{+8}, Al^{+9} and Al^{+10} ions. The resolution of the instrument is observed to be better than 0.5 Å at $\lambda \sim 55$ Å for a slit width of 100 μm. The spectrograph is being coupled to an x-ray streak camera for temporally resolved measurements.



XUV spectrum of aluminium plasma on DEF-5 film.