L.3 Enhanced zone plate coded microscopy of large size objects

Zone plate coded imaging (ZPCI) is an important technique for imaging any short wavelength incoherent radiation, which is difficult to focus using conventional reflective and refractive optics. While ZPCI enjoys large radiation collection efficiency, size of the source to be microscopically imaged is limited to the diameter of the first zone of the zone plate used for encoding. This limit on the field of view comes from interference of out-of-focus multi diffraction orders with the focused order during reconstruction of the object as illustrated in the fig.L.3.1. An enhanced digital decoding technique has been devised for digital reconstruction of the object. It increases the field of view by a factor of three without affecting the resolution and signal to noise ratio.

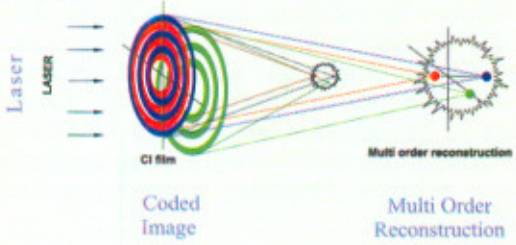

Fig. L.3.1 Multi order reconstruction of the object from a coded-image.

The technique is based on the fact that spatial frequency in a given order at a particular point in the coded image is proportional to the radial distance of this point from the centre, and it increases in proportion to the order number of diffraction. This implies that there exists progressively increasing higher cut-off limits of spatial frequency spectrum of different diffraction orders with increasing order-number. Further, for a known highest spatial frequency of the object, the information for higher orders will be contained in a disc of smaller radius in the coded image and vice versa. Therefore, the noise contribution from lower orders to a given higher order can be reduced by spatially limiting the coded image during digital reconstruction. Similarly, noise from higher orders to a lower order image can be decreased by selective propagation of the spatial frequency components after applying a low pass filter. This suppresses the inter-order noise leading to a larger field of view of the object. A computer program has been developed for digital reconstruction of the object from the coded image. Because of enhancement in the field of view this scheme can be useful for x-ray imaging of laser produced plasmas and even for imaging particle-emissions like neutrons from inertial confinement fusion.

(Contributed by: A.S. Joshi; asjoshi@cat.ernet.in)

L.4 Fabrication of nano structured velvet targets for sub-picosecond lasers

Nano structured velvet targets consist of a surface of end-standing 10-200nm diameter metallic fibers, in a structure resembling velvet fabric. Such metallic velvets are found to produce bright x-ray pulses of a few pico-second with high x-ray energy conversion. These velvet targets are electrochemically fabricated on aluminum substrates by a four-stage process, consisting of electropolishing, anodic oxidation, pore widening and electro deposition.

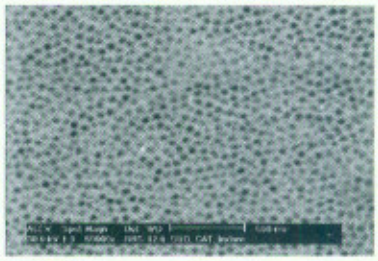

Fig.L.4.1 SEM image of Electropolished Al foil

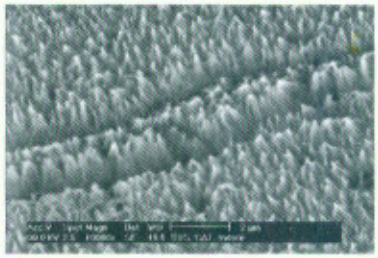

Fig.L.4.2 SEM image if anodised Al foil

Aluminum samples were first electropolished in a solution of ethanol and perchloric acid at 8°C for forming ordered hexagonal patterns (fig.L.4.1). After electropolishing they were anodized at 24°C in oxalic acid electrolyte with lead counter electrode (fig. L.4.2). The temperatures for both these processes were maintained using a constant temperature bath. The pores formed during anodization were widened in phosphoric acid at 37°C for 30 minutes. Nickel was electrodeposited inside the widened pores in a sulphate electrolyte using alternating current at 60°C for 10 minutes.

(Contributed by: P.Ramsankar; prs@cat.ernet.in)

L.5 Photodynamic inactivation of antibiotic resistant bacteria -*Pseudomonas aeruginosa*

Photodynamic therapy (PDT) is a promising approach for management of antibiotic resistant bacteria. It involves destruction of target cells by reactive oxygen species generated by photoexcitation of a photosensitiser bound to