

Fig. L.10.1 The new version of the density measurement station

The optical scanning is achieved using a polygon mounted on a brush less dc motor, which scans the laser beam, and a collimating lens generates the line scan. The duration for which the pellet obstructs the laser gives a measure of its size. The diameter and length of the pellet placed in the collimated scan region are simultaneously measured and are used to calculate the geometric volume of the fuel pellet. The weight of the pellet is acquired from a weighing machine interfaced to the system. The sintered density of fuel pellets is needed before they are taken up for assembly into fuel bundles. Three such systems have been developed for NFC, Hyderabad.

(Contributed by: A.G. Bhujle; bhujle@cat.ernet.in, S. Raja, K. Aneesh)

L.11 Digital speckle metrology

When a coherent wave is reflected from or transmitted through an optically rough surface it forms what is called a speckle pattern. It arises from the self-interference of waves generated by diffuse objects. The speckle patterns are recorded using high-resolution CCD cameras, are electronically stored and correlated numerically. Shearing Speckle Interferometry is a laser based, optical, non-contact and non-destructive method widely used for the stress and strain analysis of loaded structures and for non-destructive testing. It is an optical method based on the principle of speckle correlation where interferometer is used in shearing mode.

A system based on shearing speckle interferometry has been set up to carry out analysis, and display the resulting displacement field and the interferogram in real time. The object under inspection is illuminated with an expanded laser beam. A speckle pattern of the unstressed object is initially captured and stored in a computer as a reference image. The object is then stressed artificially by either mechanical, pressure or thermal methods, which in turn causes the object to deform. The image of the deformed object is acquired and stored as deformed image (fig.L.11.1).

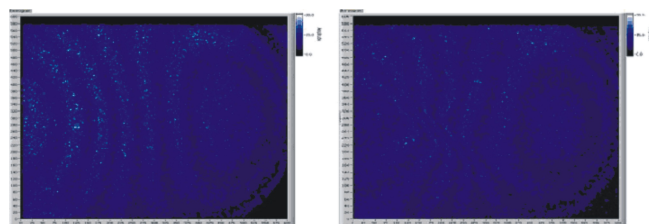


Fig. L.11.1 The specklegram of a normal and a stressed plate

Recording these subsequent speckle patterns, and subtracting them produce an image, which consists of alternating black and white fringes. The fringes correspond to the gradient of the deformation and can be used to calculate the out of plane deformation of the object. This system is being developed at CAT as a prototype for NDT feasibility studies.

(Contributed by: S. Raja, A.G. Bhujle; bhujle@cat.ernet.in)

L.12 pH dependent binding of Chlorin-p6 with lipid membranes: A fluorescence spectroscopic study

Studies are being carried out to evaluate the use of Chlorin-p6 (Cp6), a Chlorophyll derivative as a potential drug for photodynamic therapy. Our earlier studies showed that due to the presence of a number of carboxylic groups the hydrophobicity of Cp6 and hence its aggregation depends strongly on pH [Dutta *et. al. Photochem. Photobiol* 75 (2002) 488]. Since binding of Cp6 to lipid membranes and thus its cellular uptake is expected to depend on its hydrophobicity, we investigated the pH dependence of the binding of Cp6, with a lipid membrane (phosphatidyl choline liposomes).

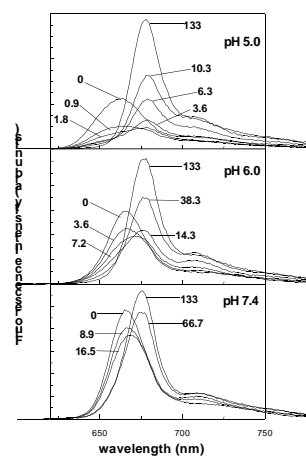


Fig. L.12.1a Evolution of the fluorescence of Cp6 with increasing amount of liposome. The increasing numbers indicate increasing amount of liposomes in phosphate buffer.

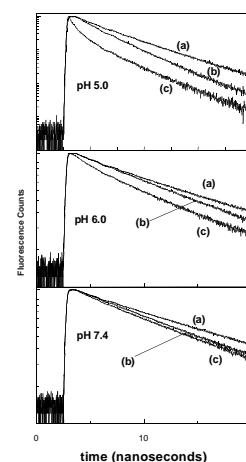


Fig. L.12.1b Fluorescence decays of Cp6 in (a) Maximum liposome; (b) No liposome and (c) with liposome concentrations corresponding to numbers 3.6, 14.3 and 16.5 in fig. 1a, for pH 5.0, 6.0 and 7.4 respectively.