This value of valence bands offset matches with the published values for samples prepared in the in-situ conditions. The importance of the present method is that it is useful for samples prepared in ex-situ conditions with film thickness of the order of 100nm. This work was done in collaboration with a team from BARC.

(Contributed by: Shailendra Kumar, S.N. Jha, Jagannath, Tapas Ganguly, S.V.N. Bhaskara Rao, N.C. Das; shail@cat.ernet.in)

A.13 W/C X-ray multilayer mirror

X-ray multilayer devices consist of periodic arrangement of alternating layers of two different materials. The reflections of incident wave field from the successive interfaces in the multilayer add in phase at the Bragg condition and gives enhanced peak reflectivity. Smooth interfaces with chemical stability between the concerned materials are important prerequisites for making an ideal device. In x-ray mirrors, the interface roughness severely degrades the optics quality. Shape of the interfaces and their correlations and conformity with underneath layers are among the most important parameters. We have studied a W/C multilayer (C ~70Å/W ~40Å) by hard and soft x-ray reflectivity measurements. The hard x-ray reflectivity measurements are carried out using CuKα radiation (λ=1.54Å) and soft x-ray reflectivity measurement at λ=80Å using Indus-1 (fig. A.13.1 and fig. A.13.2). Detailed analysis of reflectivity data reveals that, in W/C multilayer, the roughness propagates across the successive layers from bottom to top layer. It is found that the roughness propagation factors for the two types of interfaces viz. W-on-C interface and C-on-W interface are different. In case of W-on-C interface the roughness propagation is slower in comparison to C-on-W interface. Amorphous carbon, which acts as a roughness suppresser, is responsible for asymmetric interface behavior. In fig.A.13.1 the best fit represented by continuous line is obtained by accumulated roughness model. The same model has been applied for the soft x-ray measurement and results are found in good agreement with hard x-ray data.

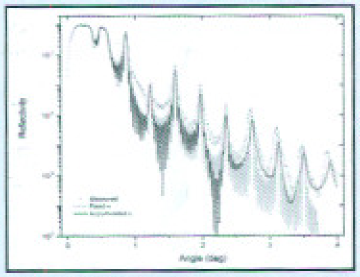

Fig. A.13.1 X-ray reflectivity spectra of W/C multilayer using λ=1.54Å wavelength is shown along with the fitted curve

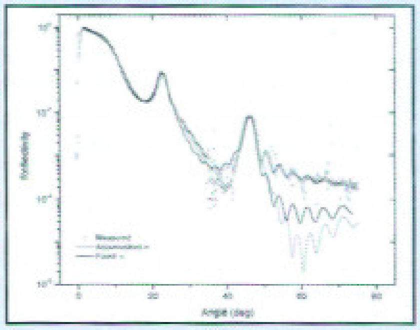

Fig A.13.2 X-ray reflectivity spectra of W/C multilayer at λ=80Å with the fitted curve.

(Contributed by: Dr. GS Lodha; lodha@cat.ernet.in))

A.14 Use of DC accelerator for radiation processing

A 750kV, 20kW DC electron accelerator designed and built at CAT, is currently being used to develop various processes relating to radiation processing of materials and food items. The beam from this electron accelerator provides an irradiation span 1.2 meters wide and (at 400keV) can penetrate 2mm deep in unit density material. The complete system is installed in a shielded area and is at present operating at 2.5kW power level, as permitted by the Atomic Energy Regulatory Board.

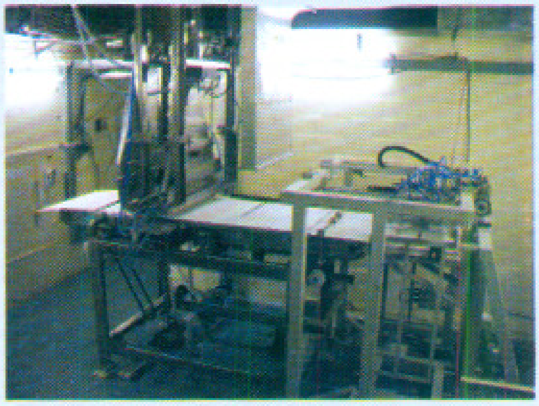

Fig.A.14.1 Irradiation of paper

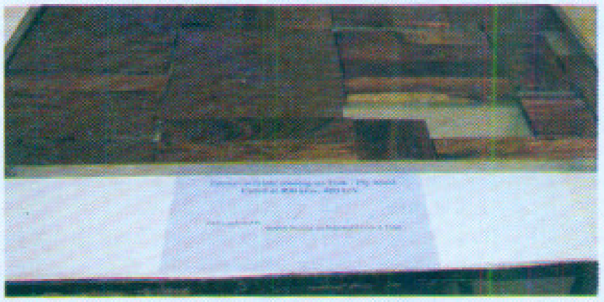

Fig. A.14.2 Irradiation of wood