

Grazing incidence X-ray fluorescence analysis of Pr doped Silicon Rich Silicon Oxide films

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X-Ray Reflectivity (XRR) is a well accepted analytical technique for the characterisation of thin films. XRR is sensitive to the electron density in surface near layers and it is able to provide information about film thickness, density, roughness. Elemental information, however, is often important to reveal contaminations possibly detrimental also in low concentrations or to gain information on dilute dopants.

Grazing Incidence X-Ray fluorescence is proposed for the elemental analysis of surface near layers due the relatively easy combination with XRR experimental set-ups.

A 100 mm² Silicon Drift Detector has been coupled to a Panalytical Xpert-MRD diffractometer equipped with a Cu anode tube source and a scintillation counter with a back graphite monochromator. The white incident beam was attenuated with a Ni filter. The SDD detector was mounted to look in the middle of the sample aligned in the centre of rotation of the theta-theta goniometer at an angle $\chi=22^\circ$ and an angle $\phi=0^\circ$ fixed in the laboratory and sample frames.

Pr doped silicon rich silicon oxide (SRSO) thin films were fabricated to investigate their suitability as a down-converter layer to enhance efficiency in photovoltaic cells. Films were deposited on single crystalline [100]-Si substrates using reactive radio frequency magnetron co-sputtering of a SiO₂ target covered by Pr₆O₁₁ chips.

GIXRF allowed to put in evidence the presence of impurities that could potentially kill the film photo-luminescence and to monitor the deposited Pr amount in dependence of Pr₆O₁₁ to SiO₂ sputtered area ratio, Ar and H₂ partial pressure, sputtering power and deposition temperature.

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