Synchrotron Infrared ellipsometry for characterisation of organic films

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FT-IR reflectance methods such as infrared spectroscopic ellipsometry (IRSE) provide valuable information about the sample properties by probing the reflectance for radiation differently polarized with respect to the plane of incidence [1-4]. From IRSE not only the real and imaginary part of the optical constants are derived but also the depolarisation within the sample can be elucidated. The in-house–built photometric mid infrared ellipsometers at ISAS together with the unique microfocus infrared ellipsometer at the synchrotron BESSY II [4] enable the implementation of microscopic effects e.g. roughness or polydomain structures into the optical model. The high analytical potential of IRSE is based on (i) a non-contact and non-invasive measurement (ii) monolayer sensitivity (iii) identification of chemical bonds of the film and interface by vibrational absorption bands and (iv) optical modelling with respect to molecular orientations and structure. Ellipsometric measurements require well defined optical conditions since reflectance depends strongly on the angle of incidence and the polarization azimuth of the incident radiation. As a consequence the focussing optic is restricted to rather moderate f-numbers and the signal to noise ratio limits ellipsometric investigations to rather large samples. Depending on technical limitations typical sample sizes for infrared ellipsometry are around a few 10 mm^2 when using a conventional FT-IR ellipsometer. Du to the high brillance of synchrotron radiation micro IRSE with defined angles of incidence is possible for lateral resolutions below 250 μm^2. In this contribution several applications of synchrotron infrared ellipsometry at BESSY II for investigations of small and heterogeneous organic thin film samples (polymers, proteins, functional moelcules) are reviewed.

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