Synchrotron IR ellipsometry for characterization of ultra thin and heterogeneous films

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It was shown recently that the detection limits of infrared ellipsometry can be improved by use of appropriate measurement strategies [1] and dedicated sources such as synchrotron infrared beamlines [2]. The method now facilitates the investigations of ultra thin films or even submonolayers of adsorbates on semiconducting surfaces. This has great technological relevance since such films, e.g. molecular films on silicon, are believed to have a potential application in the IC industry. Another question is if also biological or other samples with considerable spatial variations of the optical and chemical properties can be investigated with this method. The evaluation of the anisotropic optical constants and of the structural parameters (e.g. molecular orientation) of such samples requires an understanding of the contributions due to deviations from the commonly in ellipsometry applied layer models. This presentation shows that small and heterogeneous samples can be investigated with respect to thickness, structure and composition [3,4]. With the degree of phase polarisation P_{ph}, ellipsometry determines a value that directly reflects the heterogeneity of real world samples. It is outlined how different contributions such as roughness, varying thickness and chemical properties can be separated by applying the optical models, in particular if a highly brilliant source is used.

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