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Generalized Ellipsometry in Unusual Geometries

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Most ellipsometry experiments are performed by impinging polarized light onto a sample at a large angle of incidence, and the results are usually interpreted in terms of thin film thicknesses and isotropic optical functions of the film or substrate. Here, however, we describe briefly generalized ellipsometry experiments performed using the two-modulator generalized ellipsometer (2-MGE) in either the transmission or normal-incidence configuration. In both cases, microscope optics and serial measurements can be used to create an image of the sample comprised of diattenuation, retardation, direction of the fast axis, circular diattenuation, and polarization factor. Three examples will be presented. First, transmission mode measurements are used to determine the birefringence of z-cut crystals by tilting the sample slightly off normal incidence. Second, In transmission, the 2-MGE can also be used to measure birefringence introduced by the application of an external voltage; we will focus on semi-insulating GaAs. Finally, normal incidence 2-MGE measurements can be used to characterize optical cross-polarization generated from anisotropic samples; we will show examples from highly oriented pyrolytic graphite (HOPG) and cross sections of nuclear fuel particles.

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