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Optical Anisotropy of Organic Layers Deposited on Semiconductor Surfaces

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Abstract

The optical properties of 3,4,9,10-perylenetetracarboxylic dianhydride (PTCDA) films grown by organic molecular beam deposition (OMBD) on passivated Si and GaAs substrates were determined using variable angle spectroscopic ellipsometry (VASE) and reflectance anisotropy spectroscopy (RAS). All PTCDA layers deposited at room temperature with a low deposition rate of about 0.2 nm/min are strongly optically anisotropic and are treated as uniaxial. From the VASE measurements the in-plane refractive indices and extinction coefficients are found to be larger than the respective out-of-plane optical constants in the spectral range from 300 nm (4.13 eV) to 1700 nm (0.73 eV). The altogether lower refractive indices of PTCDA films grown on GaAs indicate a lower density of the films which can be explained by the film structure. RAS results for PTCDA films grown on GaAs show features which can be attributed to transitions between the highest occupied molecular orbital (HOMO) and the lowest unoccupied molecular orbital (LUMO). GaAs features near the E_1 gap remain unchanged upon PTCDA deposition indicating that the surface reconstruction of the GaAs substrate stays intact.

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