POLARIZATION IN NONLINEAR OPTICS: RETHINKING OLD IDEAS

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The unique symmetry properties and the remarkable chiral sensitivity of SHG and SFG combine to make them attractive methods for studies of buried interfaces. Mining the rich information content of the polarization dependence in nonlinear optical measurements can be facilitated by combining detailed polarization analysis with theoretical models for relating macroscopic effects to microscopic structure. Generalized nonlinear optical ellipsometry been developed to simplify and improve polarization analysis of surfaces and materials. As a complement to these experimental studies, new theoretical approaches have been developed to simplify the relationships between the detected signals and the molecular/macromolecular structures at the interfaces. Applications of these combined experimental and theoretical techniques include the demonstration of label-free methods for real-time biosensing, chiral-specific in situ detection and analysis with unparalleled sensitivity, and the quantification of changes in protein secondary structure from polarization analysis.