CENTER FOR NANOHYBRID FUNCTIONAL MATERIALS

THURSDAY
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3:00 – 5:00 PM
241 SCOTT ENGR CENTER
UNL

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A classical model for depolarization through decoherent superposition

A finite spectral resolution and/or an imperfectly collimated beam, and/or an (areal) extended light source, and/or an (areal) extended detector, and/or a sample with a varying thickness can produce depolarization in any polarization measurement. However, despite these experimental findings, there are to our knowledge no physical models published which trace the origin of depolarization back to atomic properties. Therefore, in the talk I will explain cross-polarization, and subsequently depolarization, by considering the ***common* - *but not separable*** - effect between the light beam and the sample, described by **coherence length and coherence area**.

In optics we never measure the electric fields, because our available detectors are much too slow, but we measure their ***statistical*** second moments. So, for two classes of samples (and beams), for inhomogeneous ones, as well as for homogeneous with dimensions larger than the coherence length, a mathematical model for cross-polarization is presented. In inhomogeneous samples the Fresnel reflectances are no longer correct because these rely on homogeneity, i.e., arbitrary shifts of the sample along any surface direction. Cross-polarization then has to take into account radiating dipoles, whose radiation creates scattered cross-polarized fields; after decoherent superposition while still fully polarized, partially depolarized light results. In any structured sample there are inner boundaries present and it is straightforward to show that the usual boundary conditions on the continuity of the tangential electric field and the normal of the displacement field yield inherent contradictions at these inner boundaries. In homogeneous samples with dimensions larger than the coherence length, however, depolarization effects can only be observed if the light rays falling on the detector (for ellipsometry, the analyzer) travelled differences in distances larger than the coherence length.

Seminar hosted by Dr. Mathias Schubert, UNL Department of Electrical Engineering

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