The depolarization in granular media: a Mueller matrix approach

Bruno Gompf

University of Stuttgart, Germany

We describe a general method to disclose the information hidden in Mueller matrices experimentally obtained from depolarizing samples. Although spectroscopic Mueller-matrix ellipsometry allows for a model-free characterization of inhomogeneous samples, i.e., independently from any assumption on the sample structure, the interpretation of the obtained results is often challenging. The proposed method combines three different decomposition techniques applied to the measured Mueller matrices in transmission and reflection of granular thin films with different thicknesses and densities. We demonstrate that the comparative analysis of the respective differential-, product-, and sum-decomposition of the Mueller matrices, together with correlation effects and the visualization as a Poincaré sphere, reveals the particular underlying physical processes of depolarization. As an example, we apply this method on granular BaSO4 thin films. This method is general and can be applied to a wide variety of intrinsically inhomogeneous materials with applications in physics, industry, biology, or medicine.