Deeper insights into 2D-Materials by Imaging spectroscopic Ellipsometry (ISE) and Imaging Mueller Matrix Ellipsometry (IMME)

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Imaging Spectroscopic Ellipsometers (ISE) combine the benefits of ellipsometry and optical microscopy in a single device. The unification of the two technologies creates a unique metrology tool that redefines the limits of both ellipsometric measurements and polarization-contrast microscopy. The enhanced spatial resolution of imaging ellipsometers (about 1 µm) expands ellipsometry into new areas of microanalysis, microelectronics, and bio analytics. Imaging Ellipsometry is an all-optical, non-contact metrology technique that excels at the layer-thickness and material characterization of micro-structured thin-film samples and substrates.

In the field of 2D materials characterization, Imaging Spectroscopic Ellipsometry enable the determination of optical properties of micro crystals [1],[2],[3]. The data are required for a better understanding of 2D material based devices [4],[5].

From the macroscopic point of view, ellipsometric contrast micrographs or microscopic maps of Delta and Psi can be stitched and offer a fast, non-contact, wafer-scale, atomic layer resolved imaging of 2D materials [6] on a variety of substrates. Including maps recorded at different wavelengths, a specific search for microcrystals with a dedicated number of layers or a predefined thickness was reported. Recent studies also show the possibility of imaging buried layers [7].

The focus of the talk will be on applications of Imaging Müller matrix ellipsometry for anisotropic microcrystals characterization. Micrographs of 11 elements of the Müller Matrix, normalized to element 1 were recorded at different wavelength and orientations for different microcrystals like Black Phosphorous or Bi_2SeO_5 (Fig, 1),

References

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Figures

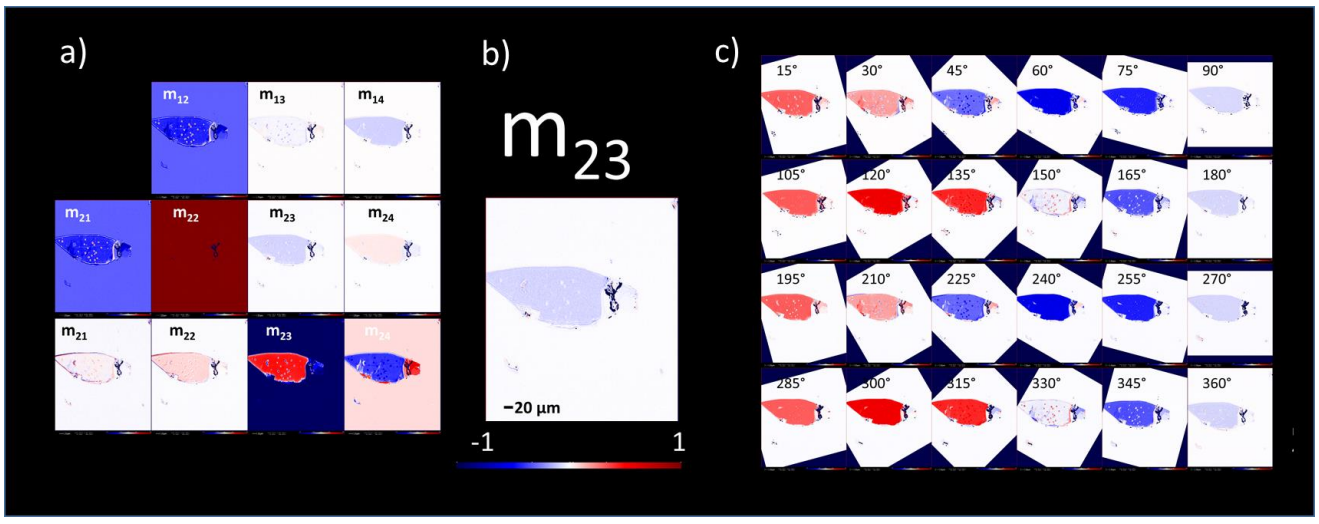

Figure 1: Microscopic Maps of 11 elements of the Müller Matrix (a), the element m_{23} in detail (b) and rotated (c) of a Bi_2SeO_5 microcrystals on SiO2 | Si substrate.