

Monday Morning, November 6, 2023

Spectroscopic Ellipsometry Technical Group Room C124 - Session EL2-MoM

Industrial Applications of Spectroscopic Ellipsometry

Moderators: **Andy Antonelli**, Nanometrics, **Stefan Zollner**, New Mexico State University

10:40am **EL2-MoM-8 Spectroscopic Ellipsometry and Reflectometry for Advanced Semiconductor Metrology**, *Shankar Krishnan*, KLA Corporation

INVITED

This presentation will provide an overview of Spectroscopic Ellipsometry (SE) and Spectroscopic Reflectometry (SR) and how they enable KLA to provide advanced metrology solutions in the semiconductor industry. It will focus on both Film and Critical Dimension (CD) Metrology and provide an in-depth look into the latest hardware, algorithms and selected applications in Logic/Foundry and Flash/DRAM. Key hardware innovations including simultaneous multi-AOI ellipsometry, Vacuum Ultraviolet (VUV) – Infrared (IR) broadband ellipsometry, small-spot and ultra-high resolution optical designs will be discussed. We will show how a multi-Angle-of-incidence (AOI) SE contains unique spectral signatures in each AOI and in selected Mueller matrix elements to enable detailed measurements in shape and profiles in the Gate-All-Around (GAA) structures. We will demonstrate how a high-resolution optical system and a combined SE+SR signal are needed in order to be sensitive to changes within small regions (zones) of a 3D-NAND film stack. The value of Deep UV/VUV photons and the enhanced sensitivity to film thickness and film composition of high-K dielectric and threshold voltage layers will be described. This presentation will also touch on the use of SE/SR to measure emerging applications involving very large-pitch structures and on transparent substrates and waveguides. Lastly we will also present a summary of recent advances in algorithms using model-based and model-assisted machine learning to solve critical metrology problems like GAA, hybrid bonding and focus-dose measurements.

11:20am **EL2-MoM-10 Ellipsometry in Industrial Applications**, *Andre Miller*, Intel

INVITED

Optical Critical Dimension (OCD) metrology, the use of spectroscopic ellipsometry on patterned structures, is the dominant inline shape metrology technique in the semiconductor industry. The technique is used to output geometric parameters for the device patterns on the wafer. This information is used to control the line, to determine processing conditions at subsequent steps and to establish correlations to predict and improve performance and yield. The primary limitations are internal model parameter correlations and requirement for a periodic structure that may not accurately represent the structures of the device.

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