



Tutorial 2B: In Line Metrology for Semiconductor Manufacturing

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Manufacturing integrated circuits (IC) with a high yield requires careful control of the more than 700 process steps. Process areas including patterning, film deposition, etching, and chemical mechanical processing all require specialized measurement methods for process control. Particle and defect detection is done throughout the manufacturing process. This talk provides an introduction to the measurements done in each process area. An overview of statistical methods used to extract information from these measurements is also discussed. Sensor based process control is also covered.

Examples of the measurement methods that will be discussed include:

- Patterning including Etch
 - CD-SEM
 - Scatterometry
 - Overlay
- Thin Film Deposition
 - Ellipsometry
 - X-Ray Reflectivity and Fluorescence
 - X-Ray Diffraction
- Chemical Mechanical Polishing
 - Profilometry
- Particle and Defect Detection
 - SEM based
 - Light Scattering Based



Prof. Alain C. Diebold is Professor Emeritus and Empire Innovation Professor of Nanoscale Science at SUNY Polytechnic Institute. He is a SPIE Fellow and an AVS Fellow. He co-led the Metrology Roadmap Technical Working Group for the International Technology Roadmap for Semiconductors which he started. This group wrote the semiconductor industry's roadmap for Metrology and Characterization for more than fifteen years. Dr. Diebold also started and led the SEMATECH Analytical Lab Managers Working Group which coordinated research, development and application of new materials characterization capability in microscopy and associated sample preparation, X-Ray diffraction and reflectivity, electron spectroscopy, scanned probe microscopy, and synchrotron based

methods. His current research covers both nanoscale materials properties and semiconductor metrology. These efforts now include the application of machine learning to materials characterization and metrology. He is a co-author of *Optical and Electrical Properties of Nanoscale Materials* which will be published by Springer Nature by the end of 2021.