Image Sensors for optical metrology in semiconductor device manufacturing

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ABSTRACT

The continuous drive to increase device density on semiconductor chips has been enabled by innovations in areas like optical lithography and transistor architectures. Extreme Ultraviolet (EUV) lithography using an exposure wavelength of 13.5 nm has been introduced and the NA of EUV lithography tools is being pushed to extreme values. In addition, the conventional planar CMOS transistor has evolved into a complex 3D-device that has enabled a further increase of device density. To ensure sufficient yield in the manufacturing of these devices precise and robust metrology of patterning parameters like overlay (OV), Critical Dimension (CD) and 3D-profile is of growing importance.

Optical metrology is a rapidly developing field for measuring these patterning parameters since it is fast and non-destructive. Many of these optical metrology tools rely on the use of image sensors and in this presentation we will present some of the overlay metrology challenges in the semiconductor industry and discuss how innovations in image sensor technology could help in solving these challenges.

Biography of Arie J. den Boef

Arie den Boef joined Philips Research Laboratories as a research assistant where he worked on characterizing the noise and coherence properties of laser diodes. In addition he studied electrical engineering at the Eindhoven Polytechnic Institute where he received a B.Sc. degree in 1985. In 1985 he joined the optics group of Philips Research where he first worked on holographic interferometry and then started working towards a Ph.D. on atomic force microscope (AFM). In 1991 he received the Ph.D. degree from the University of Twente with a thesis titled "Scanning Force Microscopy using Optical Interferometry". From 1992 till 1995 den Boef worked at Philips Medical Systems in the area of Magnetic Resonance Imaging (MRI) and in 1995 he joined Philips Optical Storage where a worked as a system engineer on CD-Recordable/Rewritable systems. In 1997 he joined ASML as a system engineer. In 2002 he joined ASML's research department where he started exploring optical sensors and measurement systems with emphasis on wafer alignment sensors and scatterometry for CD and overlay metrology.

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Den Boef was appointed part-time full professor in 2016 at the Vrije Universiteit of Amsterdam in the area of “nano-lithography and metrology”. At the university he is teaching a master course on optical wafer metrology techniques and he has set-up a small research group that explores the use of computational imaging techniques for metrology (https://arcnl.nl/research-groups/computational-imaging)

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