

# Hybrid Metrology & 3D-AFM Enhancement For CD Metrology Dedicated To 28 nm Node And Below Requirements

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## ABSTRACT

The measurement uncertainty is becoming one of the major components that have to be controlled in order to guarantee sufficient process quality and enough production yields for advanced technological nodes. Already at the R&D level, we have to cope up with the accurate measurements of sub-40nm dense trenches and contact holes coming from 193 immersion lithography or E-Beam lithography. Current production CD metrology techniques such as CD-SEM and OCD are limited in accuracy for various reasons (i.e electron proximity effect, outputs parameters correlation, stack influence, electron interaction with materials...). Therefore, time for R&D is increasing, process windows degrade and finally production yield can decrease. A new high volume manufacturing (HVM) CD metrology solution has to be found in order to improve the relative accuracy of production environment.

In this paper, we will present and discuss a new potential CD metrology solution so-called Hybrid CD metrology (HCDM) that smartly tuned various morphological data coming from different CD Metrology techniques. The final is to create added values to CD Metrology since we are at a time where if you can measure you can not manufacture. The final goal for “chipmakers” is to improve yield and save R&D and production costs through real-time feedback loop implementation on CD metrology routines. We will discuss in details one potential hybrid metrology solution through the 3D-AFM/CD-SEM couple. We will discuss about measurement uncertainty, new 3D-AFM tip design compatible with HVM, CD-SEM threshold algorithm optimization through reference metrology feedback loop. Example of applications will be shown with typical sub-40nm trenches measurements dedicated to advanced lithography process development that will demonstrate that we have succeed to push ahead the limit of the 3D-AFM and CD-SEM technologies in measuring the tight dimensions that would allow to continue its use for current and upcoming technology nodes.

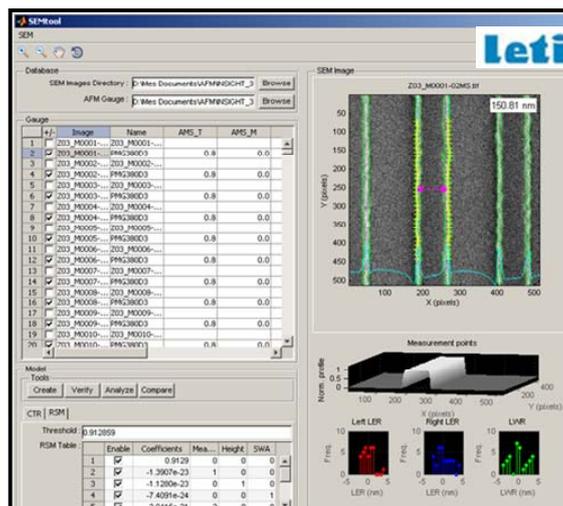


FIGURE 1. First LETI demonstrator of hybrid metrology software

Keywords: Hybrid metrology, reference metrology, 3DAFM, accuracy, precision, tip, carbon, CD-SEM

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