Joint Research on Scatterometry and AFM Wafer Metrology

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ABSTRACT

The development of sophisticated dimensional metrology is essential to meet the metrology requirements for future technology nodes. CD-metrology in particular is identified by the ITRS as an essential challenge. For production measurements scatterometers and CD-SEMs are key metrology tools. However, universal product-related reference standards for the characterisation and calibration of scatterometers are currently unavailable.

Within the European Metrology Research Program [1] (EMRP) EURAMET [2] and the European Union are funding a joint research project (JRP) with 10 participants from European national metrology institutes, universities and companies. The aim of this project is to overcome current challenges in optical scatterometry. This JRP will significantly improve and extend scatterometry methodically and regarding application areas. These extensions include the application of short wavelengths down to X-rays, a stringent exploitation of the polarisation degree of freedom, using phase information of the scattered field by scanning with a focused coherent spot and new detection schemes together with the development of improved or new concepts for modelling and data analysis.

For further refinement of the scatterometric algorithms, the impact of the structure form and local deviations must be taken into account. The necessary input on structure details will be provided by high resolution SEM and AFM methods, which have to be expanded to provide comparability to scatterometric measurements.

Finally a scatterometry reference standard will be design, developed, characterised and calibrated to face the tough specifications demanded by the semiconductor industry for future technology nodes. As a first step towards a "golden reference standard" suitable for calibration of scatterometers as well as AFM and SEM metrology tools this standard will be designed and developed to be suitable also for testing of AFMs and SEMs, so that the matching of these different types of tools will be possible.

Thus not only a comparability of these methods is introduced but also a mutual support of the partly redundant and partly supplementing information obtained by the different methods is provided. The sophisticated data analysis schemes will be developed in this JRP to reach levels of measurement uncertainty for different measurands significantly beyond the uncertainty levels reachable for each individual metrology method.

Additionally this project combines and extends the current scatterometry application fields towards surface roughness, periodically structured surfaces and diffractive optics, so that the synergy between metrology for semiconductor industry and for optics industry will be exploited.

REFERENCES

1. http://www.emrponline.eu/
2. http://www.euramet.org/index.php?id=homepage