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G Piller, L. Broch, L. Johann

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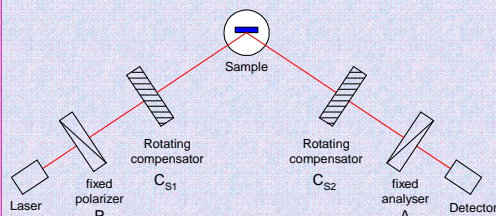
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Systematic errors for a Mueller Matrix Ellipsometer

* Corresponding author : e-mail broch@univ-metz.fr

We present the influence of systematic errors due to azimuth errors of the optical elements for a MME. This ellipsometer is based on the dual rotating-compensator principle in the PC_1SC_2A configuration developed by Collins. The first and second-order systematic errors have been characterized for all elements of the 4×4 normalized Mueller matrix and for the Jones matrix elements $\tan\Psi_{pp}$ and Δ_{pp} . We show that these errors can be eliminated by a four zone measurement technical.

Description of the PC_1SC_2A ellipsometer



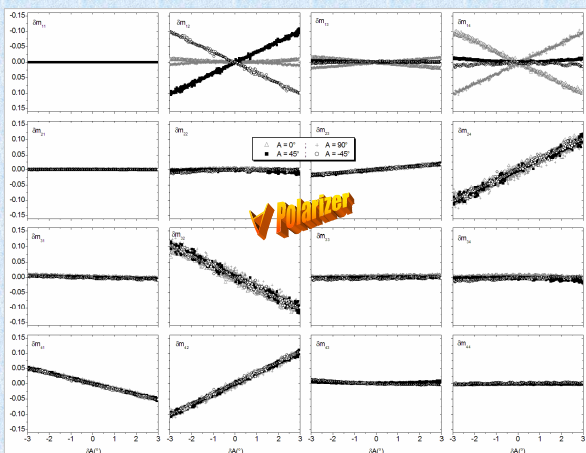
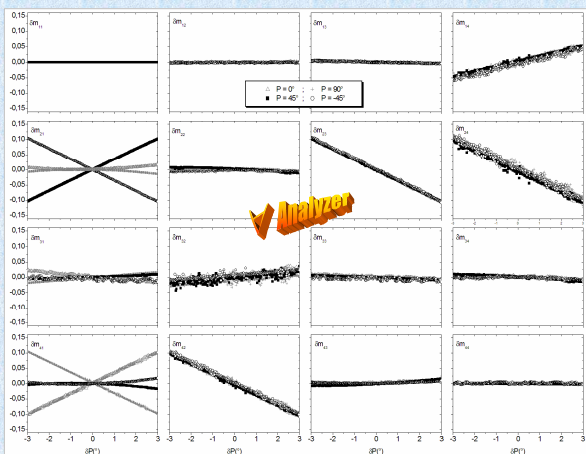
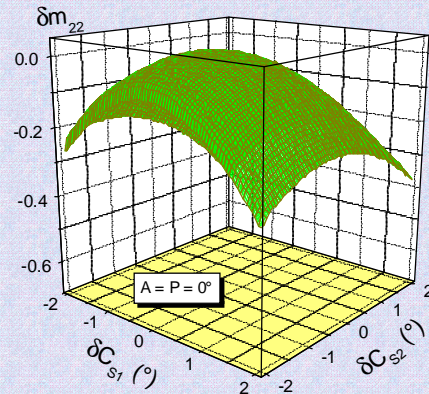
The possible azimuthal errors δA , δP , δC_{S1} and δC_{S2} induce errors both for the Mueller matrix coefficient δm_{ij} and for the Jones matrix elements $\delta \tan\Psi_{xy}$ and $\delta \Delta_{xy}$.

Overview from the errors δm_{ij} for all m_{ij} coefficients according to the azimuthal errors of the analyzer and polarizer δA , δP and of the shift angles errors δC_{S1} , δC_{S2} .

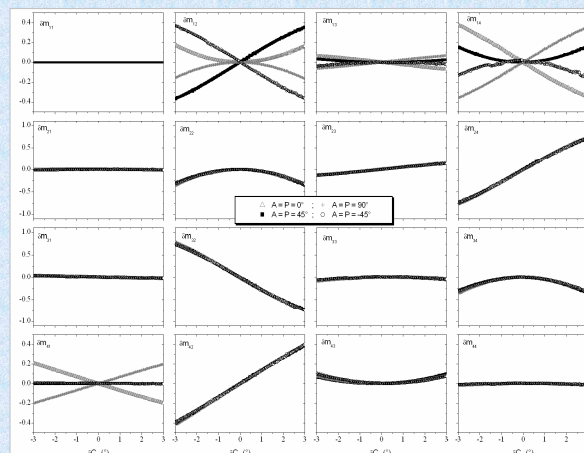
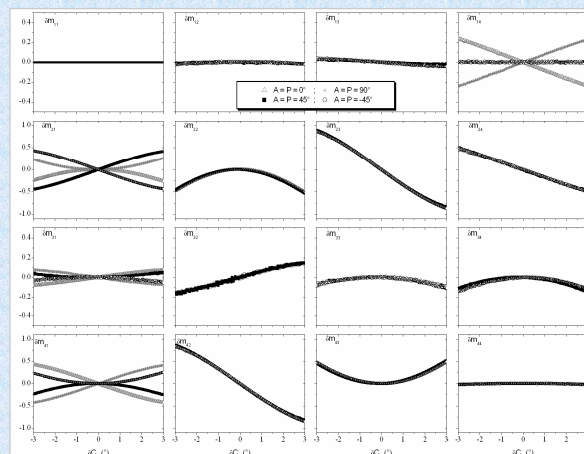
These measurements has been performed on a 106 nm - SiO_2/Si sample at $\lambda = 633$ nm and 70° of incidence.

The errors have a symmetrical distribution between (A,P) and between (C_{S1}, C_{S2}) due to the symmetrical configuration of the MME.

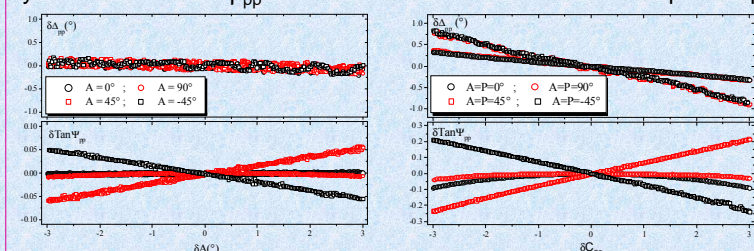
Behavior of the δm_{22} due to both δC_{S1} and δC_{S2} errors.



$$(\delta m_{ij})_{(C_{S1}, C_{S2})} > (\delta m_{ij})_{(A, P)}$$



systematic errors on ρ_{pp} have been characterized for this isotropic sample



Conclusion

We have shown the effect of the systematic errors on the Mueller matrix coefficients m_{ij} for a MME due to bad azimuthal positions of the optical elements.

- Some m_{ij} coefficients cannot be cancelled but for the another a four-measurement zone method is proposed.
- The errors due to bad shift angles δC_{S1} are greater than errors due to shift angles δA and δP .
- For an isotropic sample, only a two-measurement zone with $A = P = \pm 45^\circ$ eliminate the errors on ρ_{pp} .