

New approaches in numerical modeling of light scattered by complex optical coatings

Myriam Zerrad, Michel Lequime and Claude Amra,
 Institut Fresnel, Marseille, France, Aix Marseille Univ, CNRS, Centrale Marseille
myriam.zerrad@fresnel.fr

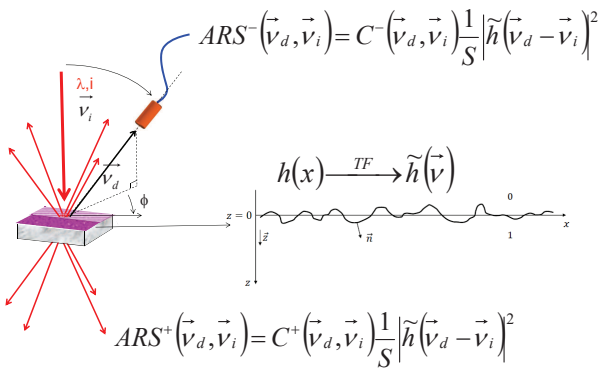


Introduction

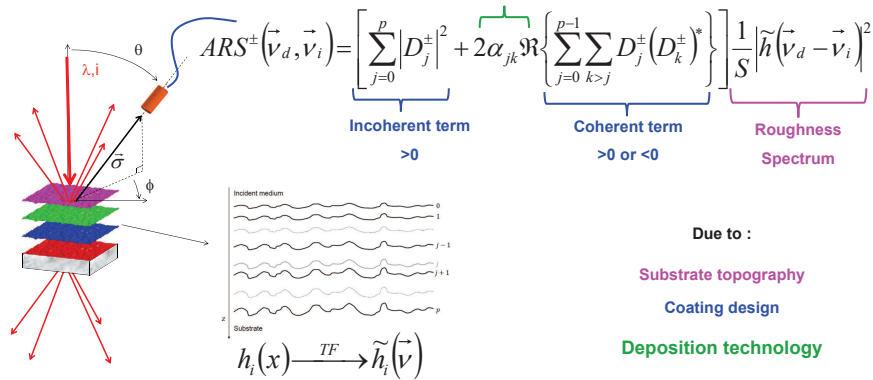
Space applications require more and more demanding optical functions. This evolution led to the development of new generation of optical components with extreme performances in terms of scattering level, roughness, localized defects, spectral evolution of performances, coherent backscattering.... In this context, optical components produced for space applications present an increasing complexity with extreme specifications. As a consequence, new problematics specific to this generation of components appeared and among them, the management of light scattering remains a significant challenge. The Light Scattering Group of the Institut Fresnel has been working on these topics for several decades and developed an optimized metrology of spectral and angular scattering which now allows to validate our scattering models with high accuracy. This led us to propose new improvements of the model in the case of complex optical coatings.

Electromagnetic model for light scattered by optical coatings

Scattering by a single interface



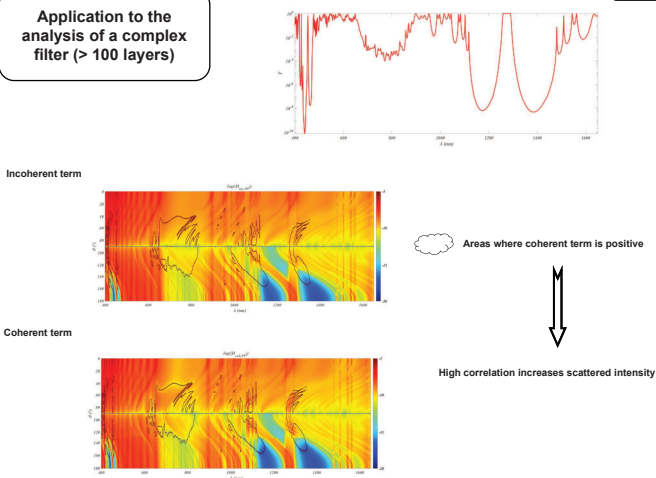
Scattering by a multilayer



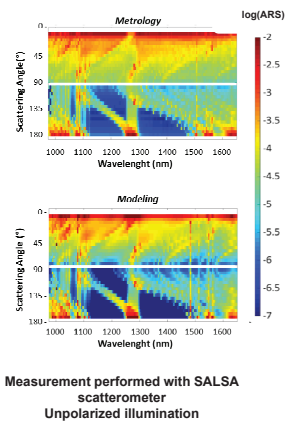
Scattered intensity is managed by the interference term and the correlation coefficients

Application

Application to the analysis of a complex filter (> 100 layers)



Comparison to metrology



References

C. Amra, M. Lequime, M. Zerrad. *Electromagnetic Optics of Thin-Film Coatings: Light Scattering, Giant Field Enhancement, and Planar Microcavities*. Cambridge University Press, 2020.

Claude Amra, J.H. Apfel, Emile Pelletier. *Role Of Interface Correlation In Light-Scattering By A Multilayer*, *Applied optics, Optical Society of America*, 1992, 31, pp.3134-3151

Claude Amra. *Light-Scattering From Multilayer Optics .1. Tools Of Investigation Journal of the Optical Society of America. A Optics, Image Science, and Vision, Optical Society of America*, 1994, 11, pp.197-210

Myriam Zerrad, Simona Liukaityte, Michel Lequime, Claude Amra. *Light scattered by optical coatings: numerical predictions and comparison to experiment for a global analysis Applied optics, Optical Society of America*, 2016, 55, pp.9680-9687.

Marin Fouchier, Myriam Zerrad, Michel Lequime, Claude Amra. *Wide-range wavelength and angle resolved light scattering measurement setup Optics Letters, Optical Society of America - OSA Publishing*, 2020, 45 (9), pp.2506-2509

Contact

