MODELING OF ELLIPSOMETRIC RESPONSE FROM PERIODIC STRUCTURE INCLUDING INCOHERENT PROPAGATION IN THICK LAYERS

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Recently, spectroscopic ellipsometry and particularly Mueller matrix ellipsometry are widely used for characterization of structures with lateral periodicity as periodic gratings, two-dimensional dot arrays, photonic crystals, periodic metamaterials, or holographic structures. High sensitivity of spectroscopic ellipsometry to a phase change, structure induced anisotropy, and material parameters opens its applications to critical dimension monitoring, characterization of lithographic processes, and overall verification of structure model. The ellipsometric response of the structures with lateral periodicity is typically modeled using matrix formalism and Rigorous Coupled Wave Algorithm (RCWA) [1].

On the other hand, the situation becomes more complex if the structure exhibit incoherent propagation and depolarization in a transparent substrate or a thick layer. Light reflection and transmission from multilayer anisotropic structure consisting of thick layers can be calculated using a recurrent matrix approach described in Ref. [2].

In this paper we propose a general method for modeling of ellipsometric response of a system with lateral periodicity including incoherent propagation in a thick substrate (or thick layers). The approach is based on incoherent summation of transforming coherence matrices in a thick layer for all optical waves diffracting by the system periodicity. The calculation is based on the scattering matrix approach. The complete Mueller matrices of both specular and diffracted beams describing general anisotropy and depolarization are obtained.

Keywords: RCWA; Periodic structures; Thick layers, Incoherent summation

References

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