Optimization of multilayer absorptive antireflection coatings for hyper-NA optical lithography

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Abstract

Hyper-NA immersion lithography addresses challenges in controlling CD of a lithographic pattern due to the difficulty in reflection control. Thus, the use of multilayer antireflection coating to further suppress the reflection is critical in 32nm, 22nm and below technology node. We propose a novel algorithm in optimizing an absorptive multilayer antireflection system in hyper-NA environment. In dual-layer antireflection coatings, for example, since the absorption coefficient of a polymeric film is tunable and affects the reflection, the number of design parameters becomes six (thickness, n and k for both layers) and therefore finding global minimum in six parametric optimization space is difficult with a conventional optimization software or algorithm. In order to provide a novel design algorithm to achieve low reflectance while providing the thickness robustness, numerical modeling, C++ coding and sensitivity analysis that search the global reflection minimum were utilized. As a final, experimental results support the simulation as an achievement of suppressing the reflectivity < 1 % using an optimized dual-layer antireflection coating system.

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