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Conventional photolithography and process optimization of pattern-size expansion technique for nanogap biosensor fabrication

Abstract

For a submicron photolithography process, there is little room for error. In this paper, an optimized technique for photoresist (PR) development is reported, to fabricate a nanogap biosensor for application in biomedical nanodiagnostics. The pattern transfer on the wafer substrate requires precise alignment and Deep Ultra-Violet (DUV) light exposure. This research describes the photolithography process to develop a standard manufacturing procedure for pattern transfer from chrome mask. The key factor for PR development is understood and the optimization is done based on the PR thickness, spin speed, spin time, exposure time, post-exposure bake (PEB) time, developer concentration and developing time to achieve the design feature size of 1 micron. The PR is coated and spun at 3000 rpm and 5000 rpm at 30s and 40s respectively to form a very thin layer. However, the UV exposure time is remained constant at 10s. After the pattern transfer, the wafer is immersed in different concentrations of RD6 developer to develop the PR. To further improve the resolution of image transfer, the PEB time is also optimized for a better throughput on feature size. These optimizations are important to reduce the dimension error and were able to achieve error free design to protect critical dimension and prevent device failure.

Keywords; Biosensor, Clinical Diagnostics, Critical Dimension, Photolithography, Photoresist