

Sustainable Non-ionic Photoacid Generators for Advanced Lithography

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Abstract: The advancement of Extreme Ultraviolet (EUV) and Deep Ultraviolet (DUV) lithography is essential for the continued progress of semiconductor manufacturing. However, the widespread use of ionic photoacid generators (PAGs), particularly those based on per- and polyfluoroalkyl substances (PFAS), has raised significant environmental concerns. As a result, sustainable alternatives to traditional PAGs have become increasingly important. This study focuses on the design and synthesis of non-ionic PAGs, which offer a key advantage over traditional PAGs by providing more uniform distribution within the resist matrix and potentially reducing defects and improves photosensitivity. In this work, we optimize n-PAG performance by modifying the structures to tune both the pKa and photo-activity of the labile bond. We demonstrate photopatterning performance of these n-PAGs in both unzipping resists (UZ) and conventional chemically amplified resists (CARs). Based on EUV and DUV studies, these n-PAGs show promising performance in the UZ resists, opening the door to a new generation of environmentally friendly, high-performance n-PAGs, for the advancement of future lithography technologies.

Keywords: non-ionic PAGs, DUV, EUV, PFAS-free, chain scissionable resist

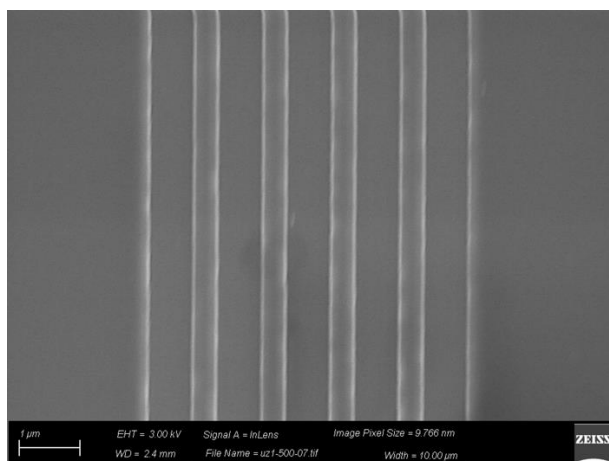


Figure 1: Scanning Electron Microscopic image of 500 nm lines with n-PAG and UZ resist at DUV exposure dose 25 mJ/cm² using IPA as developer.