Badanie granic litografii elektronowej typu greyscale na polimerze PMMA // Study of limitations of greyscale e-beam lithography on PMMA polymer

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The rapid advancement of nanotechnology in micro-optics and optoelectronics demands precise three-dimensional structures below the micrometer scale. This study investigates the resolution limits of greyscale electron-beam lithography[1] (Fig. 1) on PMMA resist using a Raith e_Line plus system. Contrast curves were measured to calibrate dose-dependent resist development, enabling controlled fabrication of stepped- and sawtooth-shaped elements with submicrometer widths (Fig. 2).

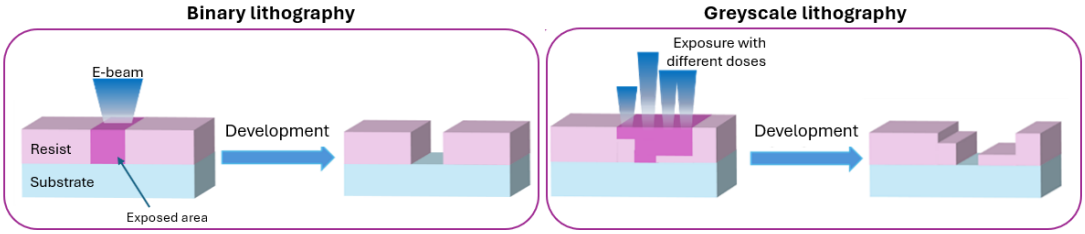

Figure 1 Scheme of difference between standard binary and greyscale e-beam lithography

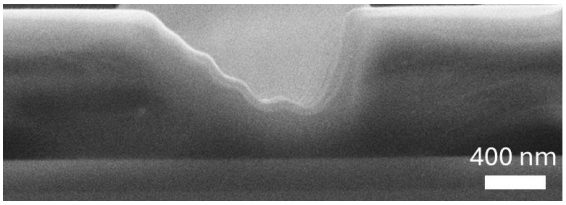

Figure 2 SEM image of stepped structure

AFM and SEM analyses confirmed reproducible high-aspect-ratio structures that surpass previously reported performance for PMMA. We discuss instrumental and exposure-parameter constraints and propose avenues for further optimization, including alternative resists and imaging methods. These findings underscore the potential of greyscale lithography for high-precision micro-optical components such as diffractive lenses[2].

References

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