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Towards a Novel Positive Tone Resist mr-PosEBR for High Resolution Electron-Beam Lithography

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Herein, we present the results of a systematic material development study we carried out in order to obtain a new positive tone resist for high resolution electron-beam lithography. Several acrylic copolymer materials with different mass fractions of the comonomers, different molecular weights and similar molecular weight distributions were synthesized and – as resist solutions – evaluated in terms of electron-beam lithography performance. On the one hand, within the ranges investigated, it was shown that the lithographic sensitivity is significantly influenced by the composition rather than by the molecular weight or molecular weight distribution. On the other hand, the etch resistance of the materials remains unaffected by changes of these parameters. The resist material exhibiting the best combination of the desired properties, mr-PosEBR, is 2 times more sensitive than PMMA (495 kDa) and performs comparably to the known high resolution resist ZEP520A. For example, a grating pattern with 29 nm wide lines with a period of 100 nm could be generated in films of mr-PosEBR with an area dose of 100 $\mu\text{C}/\text{cm}^2$. In terms of resolution, single lines of only 35 nm width could be fabricated via

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