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High-aspect ratio nanopatterning via combined thermal scanning probe lithography and dry etching

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Abstract

Thermal scanning probe lithography is an emerging nanofabrication technique for rapid prototyping of arbitrary topographies in thermally sensitive resist. This feature, paired to the recent advances in dry plasma etching techniques, allows the fabrication of high-resolution nanopatterns in hard substrates. Here, we investigate the key process parameters allowing the fabrication of high aspect ratio nanopatterns in silicon. By a combination of resist heat treatment, the use of a hard mask and optimized etch parameters during pattern transfer, we amplified the shallow resist patterns by a factor of 100 into the silicon substrate. Low surface roughness and vertical sidewalls are thereby maintained. We demonstrate the fabrication of 240 nm wide lines and 4 µm deep single crystal silicon patterns.

Introduction