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Freestanding nanowire arrays from soft-etch block copolymer templates. E. CROSSLAND, Dept. of Physics, U. of Cambridge, S. LUDWIGS, Institut fur Makromolekulare Chemie, Freiburg, M. HILLMYER, Dept. of Chemistry, U. of Minnesota, U. STEINER, Dept. of Physics, U. of Cambridge — We describe the preparation of highly ordered arrays of freestanding nanowires using block copolymer templates. The procedure consists of the alignment of the copolymer microphase morphology in a $150\mathrm{V}\mu\mathrm{m}^{-1}$ electric field, removal of the minority phase and the electrodeposition of a metal or a metal-oxide. This results in 12 nm wide and $\sim$300 nm long isolated wires. In difference to earlier work by Russell, we use a polylactide as sacrificial block, enabling its degradation in a dilute aqueous base. Template formation by polylactide degradation is useful because it avoids aggressive degradation steps, which also alters the remaining template. The template-based manufacture of hybrid materials with a well defined structure on the 10-nm scale can this way be extended to composites, in which the detailed molecular structure of all components is important. In particular we envisage application in patterning semiconductors for bulk heterojunction hybrid solar cells. In addition to the successful alignment and replication of cylindrical micro domains we report the application of this method to the more complex gyroid morphology. In the presence of an applied electric field, we observe a transition from gyroid topology to a mix of standing cylinders and lamellae.

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