Thermal probe nanolithography for novel photonic and electronic nanodevices

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Thermal scanning probe nanolithography (t-SPL) is a novel approach to nano fabrication of devices at the nano scale. It has unique capabilities beyond conventional lithography methods: Topographical 3D features can be written in one step. Furthermore, probe lithography does not cause charge-induced damage to sensitive materials (graphene, nano wire devices) or cause charge to be trapped in the device layers. The in-built topography imaging can also be used for marker-less stitching and overlay techniques. The core of thermal probe nanolithography is a heated probe tip, which is used for patterning and simultaneous inspection of nanostructures. The heated tip has a very small diameter down to 10 nm. Arbitrary high-resolution nanostructures are formed by local decomposition and evaporation of resist materials like polyphthalaldehyde (PPA). Topography imaging with the cold tip is interleaved with writing, for dynamic adjustment of patterning parameters.

As the penetration depth of the tip can be controlled for each pixel, 3D nanostructures can be patterned in a single step. This enables new application e.g. for the trapping, alignment and placement of nanoparticles or the fabrication of strongly improved optical micro-cavities.

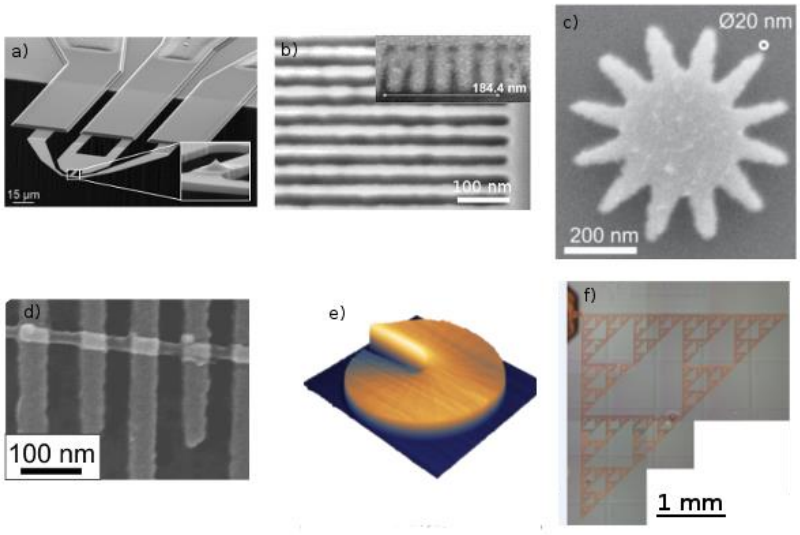

Figure 1: (a) SEM (b) Pattern transfer in Si. (c) Metal lift off (d) Overlay of contacts [6]. (e)3D spiral waveplate (f) Optical image Sierpinski triangle

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