Thermal Probe Nanolithography:

Rapid prototyping of arbitrary, high-quality nanostructures

Felix Holzner

Abstract

A novel nanofabrication technology, termed NanoFrazor, has been developed at IBM and is now commercialized by SwissLitho. Core of the technology is a heatable probe tip, which is used for patterning and inspection of nanostructures. The heated tip creates arbitrary high-resolution (<10 nm half-pitch) nanostructures by local decomposition and evaporation of resist materials. The patterning depth can be varied with 1 nm accuracy, which enables direct patterning of 3D nanostructures in a single step and with unmatched precision. The patterning speed is in the same range of high-resolution Gaussian shaped e-beam lithography and a scan speed of 20 mm/s with a pixel rate of 500 kHz has been demonstrated. The written nanostructures are inspected by the cold tip already during the patterning process. This online inspection capability enables turnaround times of minutes and novel concepts for marker-free stitching and overlay with better than 10nm accuracy. The technology is compatible with high resolution pattern transfer processes, like reactive ion etching, electroplating or lift-off.

The NanoFrazor technology has become the first cost-effective alternative and extension to conventional mask-less lithography technologies like e-beam lithography. First applications like multi-level archival data-storage, directed alignment and placement of nanoparticles, and a novel concept for optical micro cavities with improved performance have been demonstrated.

Company description

SwissLitho is a young high-tech company with the vision to change the way nanostructures are commonly made. SwissLitho is a tool manufacturer with the patented NanoFrazor being the main product. The company has an international and interdisciplinary character with physicists, material scientists and software and electrical engineers from 7 different countries. It was founded in 2012 by Felix Holzner and Philip Paul and is located in the Technopark Zurich.

Bio

Felix Holzner joined the Nanofabrication Group at the IBM Research Laboratory in Zurich in 2009. There, he started to work on the technology and on applications of Thermal Desorption Scanning Probe Lithography. After several technological breakthroughs, Felix shortened the name of the technology to NanoFrazor and started to develop the business idea of SwissLitho. He founded SwissLitho in 2012 together with Philip Paul.

Felix is a physicist by training and received a PhD from the Department of Materials at the ETH Zurich and holds degrees in physics from the University of Canterbury (New Zealand) and the University of Tübingen (Germany). On the business side, Felix gathered skills in numerous intensive business courses with a highlight in June 2013: Felix was selected to join the venture leaders , a business development program in Boston for the 20 most promising Swiss startup companies.

As CEO of SwissLitho Felix managed to raise funding from various sources: The McKinsey Venture award, all three venturekick awards, the ZKB Pionierpreis Technopark and the Heuberger Winterthur Jungunternehmerpreis. Furthermore, Felix holds the IBM Plateau Invention Achievement Award and an ETH Pioneer Fellowship. SwissLitho is collaborating in a Swiss CTI project and an EU R&D project.