Novel cost-effective nanoimprint lithography method improves ordering in periodic arrays from BCPs

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Block copolymers (BCPs) are the most attractive alternative to date for the fabrication of well-defined complex periodic structures with length scales below 100 nm. Such small structures might be used in a wide range of technological applications but current available methods are very expensive, especially when those structures present length scales under 20 nm.

A work led by the Institut Català de Nanociència i Nanotecnologia (ICN2) Phononic and Photonic Nanostructures Group suggests a new method to produce hexagonal periodic arrays with high fidelity while reducing time and costs. ICREA Research Professor Dr Clivia M. Sotomayor Torres and Dr Claudia Simão conducted, together with the authors listed below, a work published in the latest issue of *Nanotechnology* and featured cover article.

The methodology consists on *in situ* solvent-assisted nanoimprint lithography of block copolymers, a technique which combines a top-down approach - nanoimprint lithography - with a bottom-up one - self-assembled block copolymers (bottom-up). The process is assisted with solvent vapors to facilitate the imprint and simultaneous self-assembly of high Flory-Huggins parameter BCPs, the ones that yield sub-15 nm size features, in what has been called solvent vapors assisted nanoimprint lithography (SAIL).

SAIL is a scalable technique which has shown its efficiency over a large area of up to 4 square inches wafers. The resulting sample was analysed using different methods, including field emission scanning electron microscopy (FE-SEM) and grazing-incidence small-angle x-ray scattering (GISAXS). The latter was performed at the Diamond synchrotron light source (UK) and allowed characterisation of structural features of the nanostructured polymer surfaces. It is the first time that GISAXS has been used to analyse a direct-nanoimprint BCP sample.

The results obtained with SAIL demonstrated an improvement in ordering of the nanodot lattice of up to 50%. It is a low cost, scalable and fast technique which brings self-assembled BCPs closer to their industrial application. These versatile materials are very interesting for applications such as storage devices, nano-electronics, low-k dielectrics or biochemical applications.

More information: Claudia Simão, Worawut Khunsin, Nikolaos Kehagias, Mathieu Salaun, Marc Zelsmann, Michael A Morris, and Clivia M Sotomayor Torres. Order quantification of hexagonal periodic arrays fabricated by in situ solvent-assisted nanoimprint lithography of block copolymers. *Nanotechnology*. 25, 175703 (2014). DOI: 10.1088/0957-4484/25/17/175703

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