Drop-on-demand Ink-jet printing of functional materials: Case studies of SU-8 and NCs-embedded Polymer nanocomposites

J. Y. KIM[1], V. Fakhfouri[1], C. Ingrosso[2], M. Striccoli[2], M. Lucia Curri[2], and J. Brugger[1,*]

[1]Microsystems Laboratory, Ecole Polytechnique Fédérale de Lausanne (EPFL), CH-1015 Lausanne, Switzerland,

[2]CNR-IPCF sez. Bari, c/o Dip. di Chimica, Universita` di Bari, via Orabona 4, I-70126, Bari, Italy

An ink-jet printing process has been developed, which allows the design and flexible fabrication of structures on various substrates, without any expensive lithographic masks and further processing. The main asset of ink-jet printing technology is that the functional material can be printed where desired and no developing steps are required. This technique is very simple when the ink-jet printing parameters are optimized, and flexible when compared to photolithography. Moreover, this is a cost-effective process when expensive commercial or custom designed inks are used. The drop-on demand (DOD) mode is a method where single drops are generated and printed at the desired position and time with high accuracy and with reduced material waste.

In this paper the DOD ink-jet process is used for two applications: i) fabrication of microlens arrays using SU-8 in gamma-butyrolactone (GBL), ii) printing of single-/multi-color pixel arrays using nanocrystals (NCs) embedded polymer nanocomposites in $CHCl_3$. The ink-jet printing parameters are optimized in order to generate stable and reproducible drops for each material in both continuous and drop-on-demand (DOD) modes. Finally, we fabricated arbitrary patterns of (i) convex microlens arrays and (ii) single-/multi-color pixel arrays on surface-functionalized substrates. We also investigated the influence of the surface conditions on the size and shape of the printed patterns, which can be affected by wetting properties. Further characterization and results will be presented in the paper.

This work was partially supported by the EC-funded project NOVOPOLY (Contract No STRP 013619).

(Primary Author's Biography)

Joo Yeon KIM received her Ph.D. in material science and engineering from the Hannam University in 2006. She then worked at Korean Institute of Materials and Machinery (KIMM) as a research fellow to improve the hydro-philic/phobic properties of the materials for UV nanoimprinting lithography (UV-NIL). In 2007, she joined Prof. Juergen Brugger's group at Ecole Polytechnique Fédérale de Lausanne (EPFL) as a post-doctoral research fellow with her interests in ink-jet printing for micro-/opto-electronic applications with electrical/optical grade polymers and polymer nanocomposites.