# Embedded nano channels fabricated by non–selective reverse contact UV nanoimprint lithography technique

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In this work, a novel nanofabrication technique is presented, namely non-selective reverse contact ultraviolet nanoimprint lithography (RUVNIL). It is based on reverse nanoimprint lithography and ultraviolet contact lithography. We have investigated and optimized the imprinting parameters that are required for three-dimensional nanofabrication and applied them for the fabrication of nano-fluidic channels.

Figure 1 illustrates the fabrication process. First a lift off resist (LOR) film is spin coated on a Pyrex substrate. Following this, a mr-NIL 6000 polymer layer is spin coated on the LOR layer and pre backed for 5 min at 120 $^{o}$C. The LOR layer promotes the mr-NIL 60000 layer to adhere to the Pyrex substrate, increases the uniformity of the spin-coated layer and in addition helps in the release stage as will be seen. Nanoimprint lithography (NIL) is carried out in order to pattern 1 μm pitch size gratings, which will be used as the nano channels. Onto a different Si substrate, we spin coat a thin mr-NIL 6000 layer and pre baked it at 120 $^{o}$C for 5 min. This layer is used as a sealing layer. Subsequently by using non-selective RUVNIL technique, the pre-patterned gratings structures are transferred onto the flat mr-NIL 6000 polymer layer. For this step a 20 sec UV light exposure is applied once the sample has reached 50 $^{o}$C. The UV light exposure is critical in order to crosslink the whole assembly. Next 40 bars of pressure is applied for 5 min in order to make the polymers adhere to each other. Figure 2 presents 400 nm wide and 350 nm high embedded nanochannels fabricated using the described technique. In contrast to the selective pattern transfer mode [1], in the non-selective transfer mode the hybrid stamp does not incorporate any metal protrusions. The remaining residual layer of the NIL process is then taken as an advantage to fabricate embedded nanochannels.

In conclusion, we have demonstrated that the RUVNIL technique is a novel and robust method to obtain high-quality, nanochannels in the same polymer matrix, which is suitable for bio-applications. At present, fluidic experiments are under progress to qualify the channels for these applications.

[1] N. Kehagias et al, J. Vac. Sci. Technol. B 24 (2006) 3002.

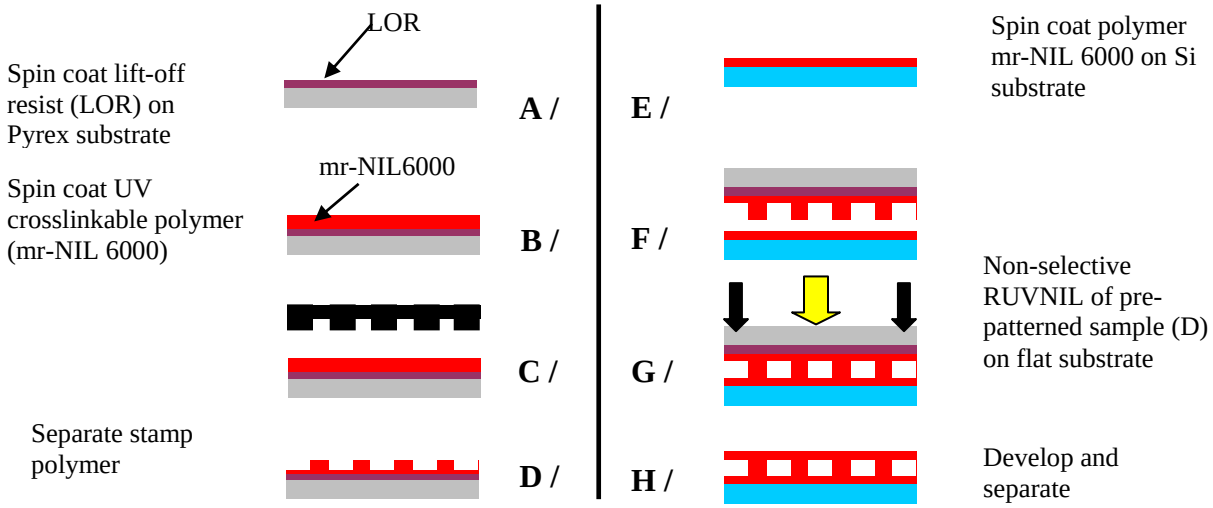


**Figure 1 Schematic of the nano channels fabrication steps using non-selective RUVNIL technique**

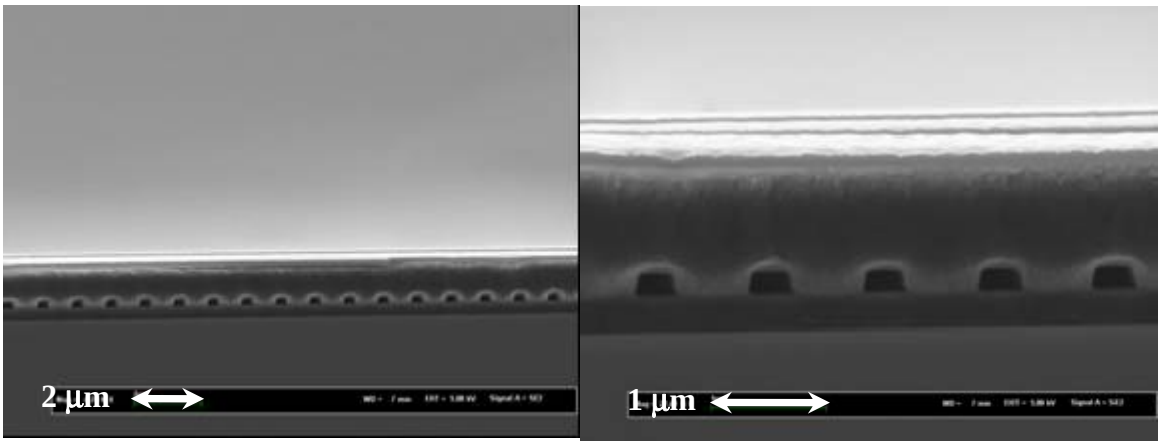


**Figure 2 Cross-section SEM image of ~400 nm embedded nano channels surrounded by the same UV crosslinkable polymer mr-NIL 6000.**

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