Pencil patterning: A spatially resolved method for tuning the wettability of PDMS

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Poster

PENCIL PATTERNING: A SPATIALLY RESOLVED METHOD FOR TUNING THE WETTABILITY OF PDMS

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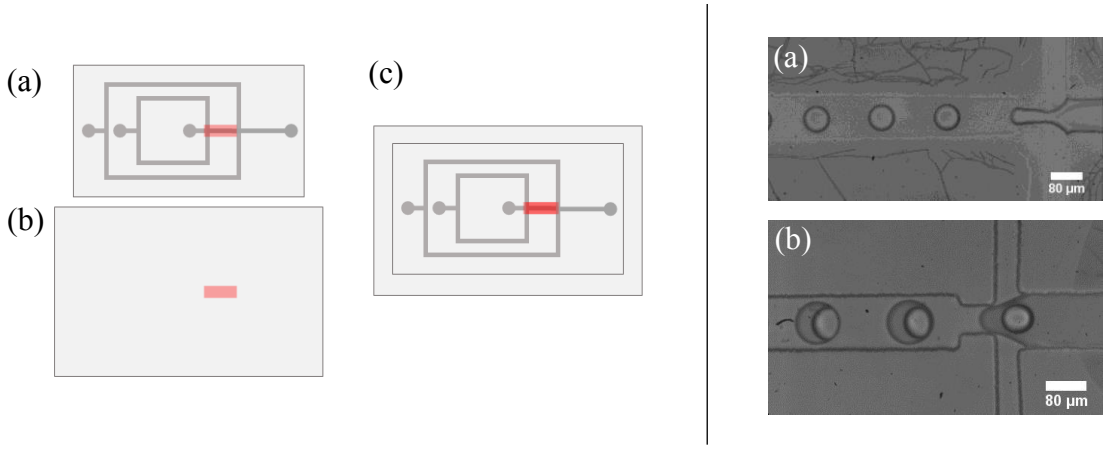
For the past few years, polydimethylsiloxane (PDMS) has been a material of growing interest. Easy to use and modify, inexpensive and biocompatible, PDMS offers plenty of applications, especially in the field of microfluidics.
However, in many applications, surface patterning of PDMS is needed like for making microfluidic circuits out of it. A very important application is the formation of double emulsion in PDMS microfluidic chips. This kind of emulsions is very attractive in many fields like food, cosmetics or pharmaceutics. To form droplets in microfluidics, the internal liquid must not wet the walls of the channels. In the case of double emulsions, this implies to make one part of the chip hydrophilic – to form oil-in-water droplets – and the other part hydrophobic – to form water-in-oil droplets. Several techniques were already investigated to achieve that goal [1–5], but neither of them offers both simplicity and spatial resolution.

In this work we present such simple and resolved method to pattern the wettability of the PDMS. It is well known that the surface of PDMS can be made hydrophilic thanks to a plasma treatment which oxidizes the siloxane groups of the surface. This property was used here to make the PDMS hydrophilic and mask the parts that need to remain hydrophobic with a permanent marker during the plasma treatment. The areas protected by the ink stay hydrophobic, and the ink can be fully removed **after** the bonding of the chip by injecting ethanol or isopropanol inside the channels. Using this technique we were able to form water-in-oil-in-water emulsion in a controlled way. Other applications of this method could be also considered, like the formation of oil-in-water-in-oil double emulsions or high-order multiple emulsions.



Left : *Schematic representation illustrating the principle of the technique, (a) chip and (b) flat PDMS with the parts that need to remain hydrophobic protected by ink (in red), (c) the chip after bonding -* ***Right:*** *Use of a patterned chip to form double emulsion, (a) formation of water-in-oil droplets without wetting and (b) formation of water-in-oil-in-water droplets.*

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