Optimisation of fabric parameters for textile microfluidic chips

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Abstract: Microfluidics makes it possible to study and manipulate micro-volumes of fluid in devices ("chips") on a micrometric scale, and has applications in the fields of biology and healthcare.

One microfluidic chip fabrication technique, known as "sacrificial moulding", involves moulding a sacrificial monofilament into a matrix [1], [2], [3]. Once moulded, the monofilament is mechanically extracted and its imprint forms a microfluidic channel. The disadvantage of this method is that it is manual, and therefore unlikely to be industrialised.

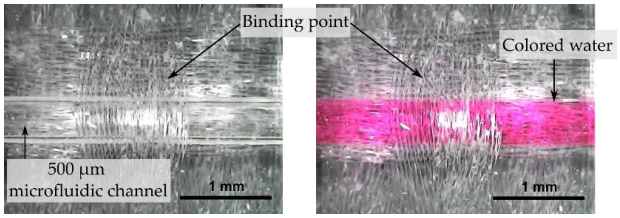
Sacrificial moulding can be combined with woven reinforcement [4]. The purpose of the woven reinforcement is to hold and position the sacrificial monofilament during the impregnation phase. By using a woven reinforcement, large-scale production of microfluidic chips can be envisaged.

The aim of this work is to determine the optimum fabric parameters for producing a microfluidic chip. Three parameters are investigated, i.e. (i) weave diagram (ii) number of binding points (iii) float length of the binding point.

In order to assess the influence of these parameters, 13 fabrics were produced to hold and position a polyamide monofilament, and impregnated in a PDMS matrix. The extraction force of the sacrificial monofilament and the visibility of the microfluidic channel were measured. For all the woven structures tested, the microfluidic channel is 200 mm long with a circular cross-section (diameter: 500 µm). In addition, the microfluidic channel produced is functional (no leaks, no cracks) (Figure 1). The addition of a woven reinforcement facilitates the removal of the sacrificial monofilament. On the other hand, the addition of a woven reinforcement reduces the visibility of the microfluidic channel.

Consequently, there is a trade-off between visibility of the microfluidic channel and removal of the sacrificial monofilament.

Keywords: *composite, microfluidic system, woven fabric reinforcement*



(a)

Figure 1 Channel of the microfluidic textile chip produced

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