

Student project

Developing a new type of microfluidic device

Introduction

Traditionally, microfluidic devices are fabricated as channels fabricated in thick, solid pieces of material by methods such as Soft Lithography, milling, etching, or 3D printing. However, for some applications thin and flexible devices, built up from several layers of material, could be beneficial.

Potential advantages of such devices include:

- Good potential for upscaling, cheap fabrication of devices.
- Soft and bendable devices - potentially ideal for applications in wearable technology.
- Possibility to easily combine different materials, add intermediate layers.
- Potential for producing multi-layer, 3D devices.

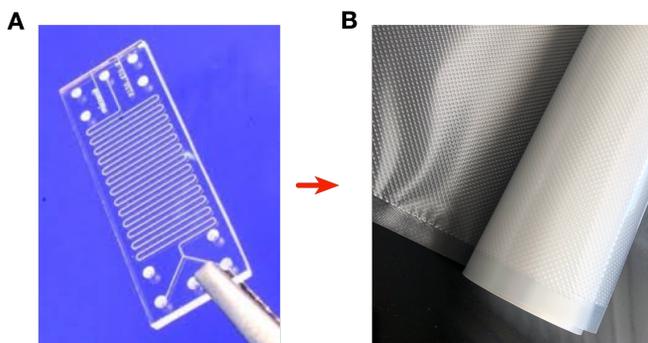


Figure 1: From thick and stiff devices to thin and flexible devices. (A) Traditional microfluidic device made by Soft Lithography. (B) Vacuum foil, as used in the packaging of food, as a starting point for creating flexible microfluidic devices.

An alternative: Vacuum foil

Vacuum foil, such as used in vacuum packing of food, could be an interesting inspiration for the development of a new type of microfluidic device. As shown in Fig.1 (B), at least one layer of such vacuum foil exhibits protrusions in the surface, which ensure the continued flow of liquids and air during suction. The sides of the bag are sealed by hot

pressing. We envisage that a combination of these features can be employed to create a new type of flexible microfluidic device that could offer the abovementioned potential advantages.

Project

This project is suitable for a student who is interested in experimenting with different techniques in the lab and come up with new practical solutions for fabrication. An important part of the project will be to investigate different methods of heat sealing of polymeric foils/films that could enable the creation of structured seals between the different layers (definition of channels in the device); some typical methods for heat sealing are illustrated in Fig. 2.

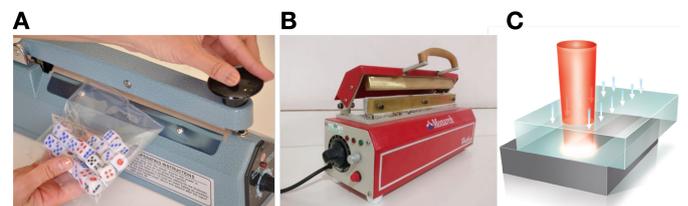


Figure 2: Typical methods for simple heat sealing. (A): Hot wire sealing. (B): Hot bar sealing (or Direct Contact Thermal Sealing) (C): Laser sealing / laser welding.

The main goals of your project are:

- Development of a simple proof-of-principle microfluidic device made from vacuum foil.
- Testing and optimization of different thermal bonding methods, enabling the production of structured sealed areas between the different layers of the devices.
- Testing and optimization of methods for connecting fluid inlets and outlets to the devices.
- Application of the developed technologies to the fabrication of microfluidic devices with a practical purpose, such as a microfluidic static mixer, or a water purification device.