Introduction

“Point-of-Care” (POC) testing is a method to carry out a medical diagnosis outside a central diagnostic lab – for example at the family doctor’s office, in an ambulance, or even at home. This can have great advantages, but it will only be feasible if a POC test can be done fast (within minutes), with small samples (e.g. a fingerprick of blood), is easy to use, is still sufficiently sensitive, and is not too expensive. At TU/e, a new method has been invented to sensitively detect antibodies in small samples of blood which is promising as a POC test, by detecting a color change that is triggered by a biochemical reaction, simply by using a smartphone (Fig. 1).\[1\] This has now been shown in a lab environment, however to develop this further towards a product, a chip must be developed that allows for this method to be done in an autonomous, fast, and east-to-use manner.

Project

The aim of this project is to design, fabricate, and test such a microfluidic chip, where we will focus on the “fluidic operations” rather than the biochemical reaction. The chip must have a number of functions: (1) sample intake, i.e. the small liquid sample (fingerprick of blood) is applied at an inlet where it is taken up into the device; (2) blood cells are automatically filtered; (3) the sample is split into several portions and led to micro-reaction chambers, where the sample is mixed with reagents and the biochemical reactions take place; (4) the sample is lead to a detection chamber at which the possible color change can be detected using an external device such as a smart phone. To achieve the required ease-of-use, all these operation should work automatically, e.g. using capillarity to pump the liquid, and using geometrical features to promote mixing. Also, in designing the chip and choosing the fabrication method to be used, the possibility of eventually producing the chips in large quantities and at acceptable cost should be taken into consideration.

The project will run in the Microfab/lab, where a range of fabrication facilities and microfluidic testing facilities are available. The project is in collaboration with the group of prof. Merkx at BME, and with dr. Jan Bernards at Fontys Hogeschool at which lab facilities can also be used.

References