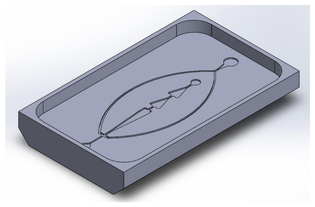
3D Printer Applications in Microfluidic Devices

Michael Sween
Gordon Hoople PhD, General Engineering

University of San Diego®

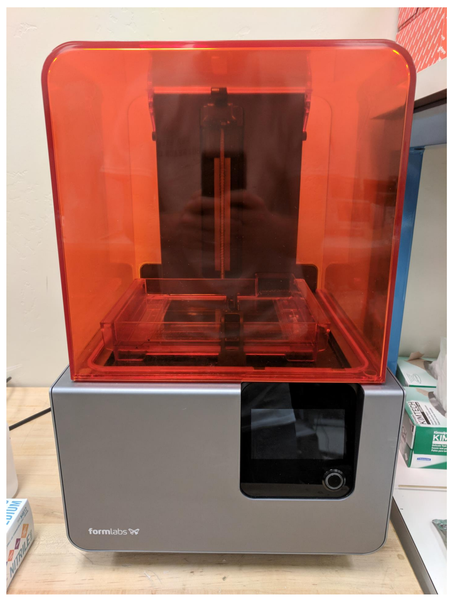
PROCESS

- A microfluidic device is designed using Computer Aided Design software
- The device mold is printed using the Form2 3D printer and then cleaned
- A cast is made of the device using the mold and a Silicone elastomer
- The Silicone cast is pressed into TPC plastic for the final device



Equipment

- The Form2 3D printer using stereolithography to print parts



OBJECTIVES

- Characterize the microscale fabrication capabilities of the Form2 3D printer
- Identify optimal parameters for fabricating micro scale features with high degrees of precision, accuracy, and reliability
- Develop a standard processes for the prototyping of microfluidic devices
- Fabricate a droplet generator, a common device used in lab on a chip applications such as DNA sequencing

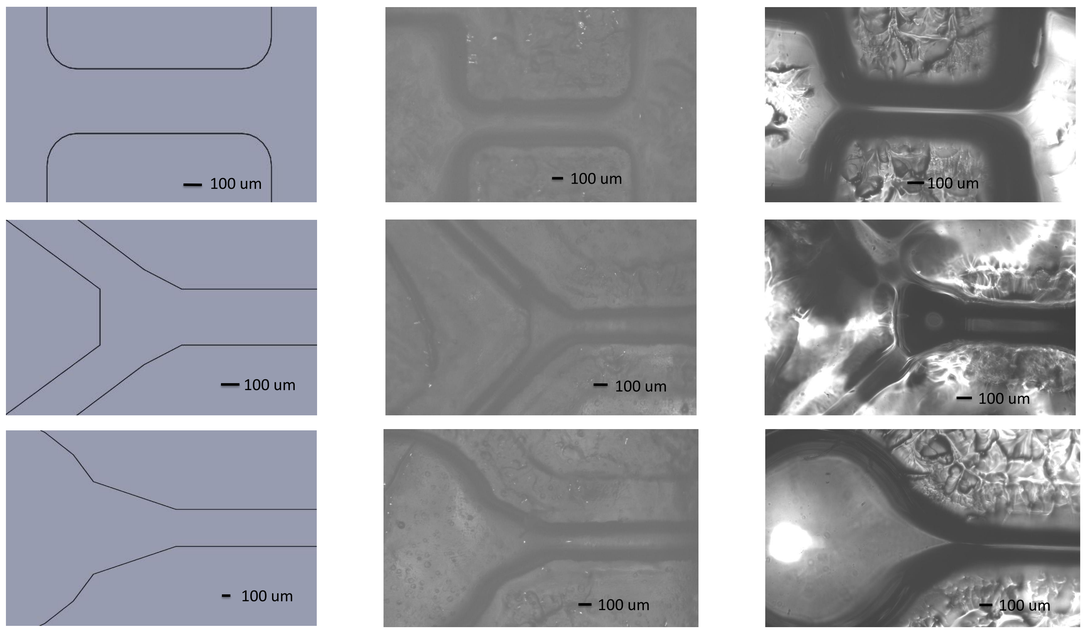
CONCLUSIONS

- Enclosed channels printed directly into the part have been unable to form at small enough sizes and remain stable
- Minimum successful size has been around 600 micro-meters for vertical prints and 800micro-meters for horizontal prints
- Further processing beyond the printing is required to develop microfluidic devices using the Form2 3D printer
- Corners form with rounded characteristics and are unable to form pointed tips
- Minimum channel width is 400 micron-meters

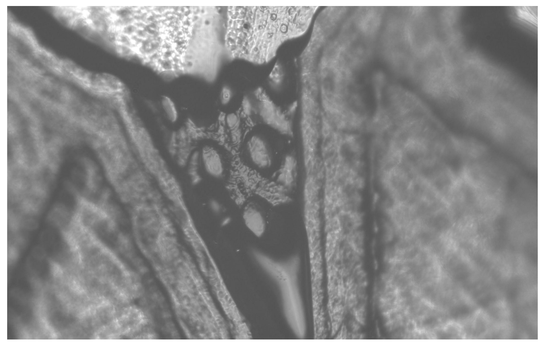
ABSTRACT

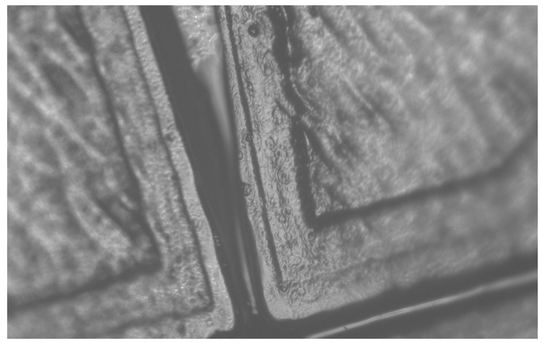
The overall goal of my research is to determine the capabilities of a particular 3D printer, the Form2, for manufacturing microfluidic devices. As a part of this larger goal I will characterize the microscale fabrication capabilities of the Form2 3D printer, identify optimal parameters for fabricating micro scale features with high degrees of precision, accuracy, and reliability, develop a standard processes for the prototyping of microfluidic devices, and fabricate a droplet generator, a common device used in lab on a chip applications such as DNA sequencing.

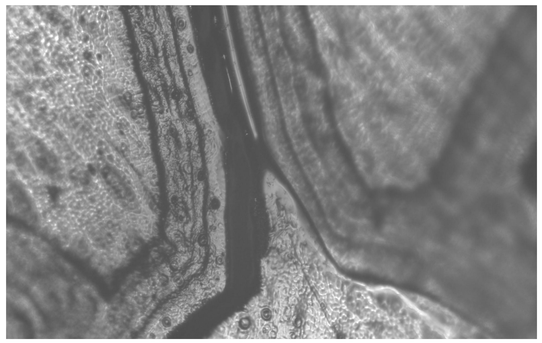
KEY POINTS THROUGH THE STAGES



FAILURE POINTS







Images taken using Mitutoyo Corporation optical microscope and Edmunds Optical camera

APPLICATIONS

- Microfluidics are increasing in importance with application in the fields of artificial photosynthesis, lab-on-a-chip, biodefense, molecular analysis, molecular biology, tissue engineering, and microelectronics