

The potential of laser processing as a tool for microfluidic medical device production

Authors

Chayan Bishayee

Affiliations

Micronit BV

University Of Twente, Chair of Laser Processing, the department of Mechanics of Solids, Surfaces & Systems (MS3)

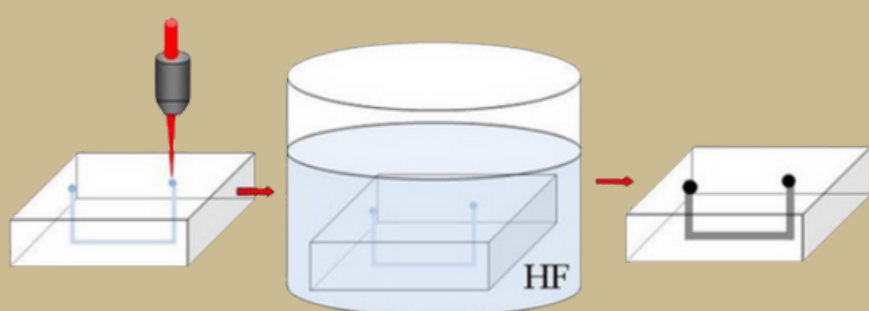
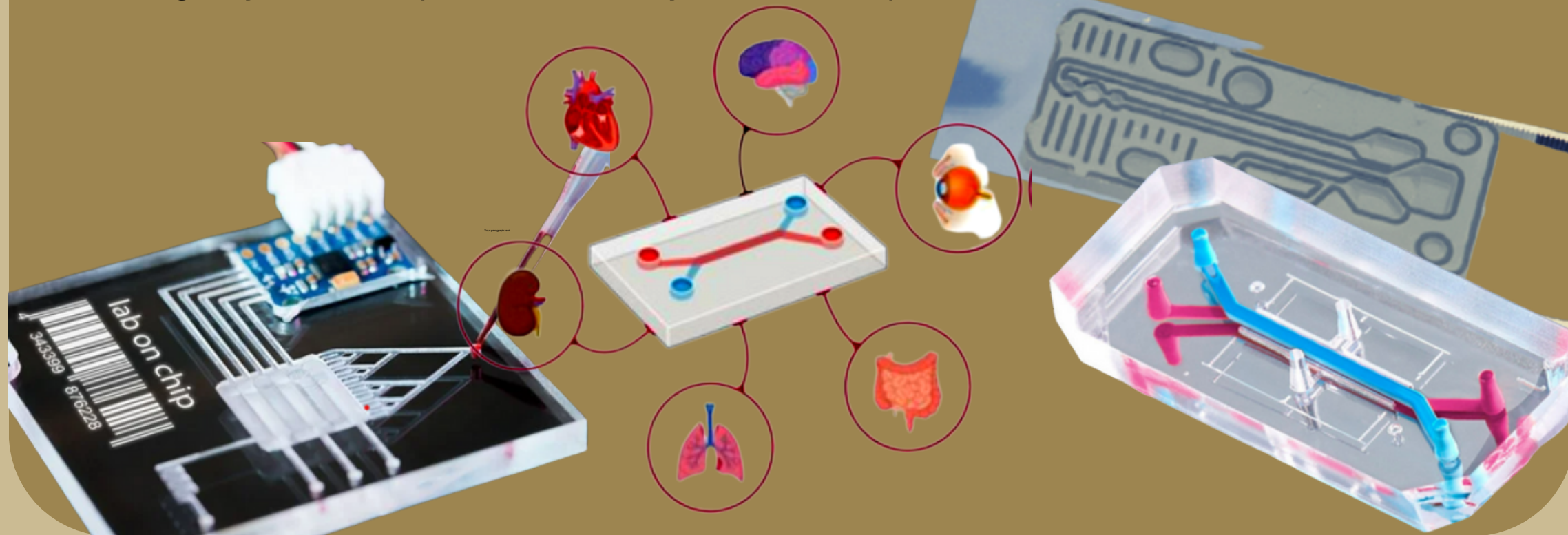
Related literature

- Roth, G. L., et al.(2019). A new approach to seal polymer microfluidic devices using ultrashort laser pulses. *Journal of Laser Micro Nanoengineering*, 14(1), 49–53.
- Boglea, Andrei, Alexander Olowinsky, and Arnold Gillner. "Fibre laser welding for packaging of disposable polymeric microfluidic-biochips." *Applied Surface Science* 254.4 (2007): 1174–1178.
- [3] Mäntymäa, A., Halme, J., Välimäa, L., & Kallio, P. (2011). The effects of laser welding on heterogeneous immunoassay performance in a microfluidic cartridge. *Biomicrofluidics*, 5(4), 046504.
- [1] Zhang, D., Men, L., & Chen, Q. (2011). Microfabrication and applications of opto-microfluidic sensors. *Sensors*, 11, 5360–5382
- [2] Trantidou, T., Friddin, M. S., Gan, K. B., Han, L., Bolognesi, G., Brooks, N. J., & Oes, O. (2018). Mask-free laser lithography for rapid and low-cost microfluidic device fabrication. *Analytical chemistry*, 90(23), 13915–13921

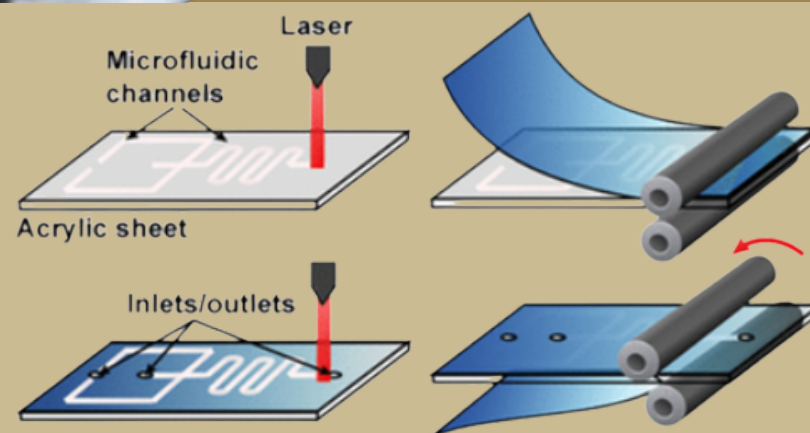
Introduction

Polymer microfluidic devices are used for point-of-care diagnostics, such as DNA screening, drug testing, Lab-on-chip etc. These devices will revolutionize the field of medicine and this project aims to bring it one step closer.

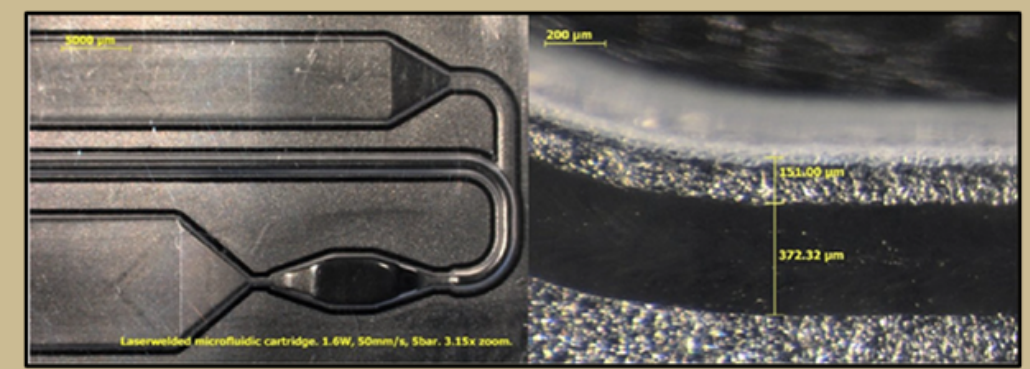
Conventionally of such devices are fabricated by cutting, milling and gluing of thermoplastic plates using milling machined and thermal bonding. There were multiple steps involved leading to more production time, increased costs and more possibility of contamination. Such methods have limitations like their incompatibility with biologically active components. This study address to surpass these limitations.



Microchannel formation using laser [1]



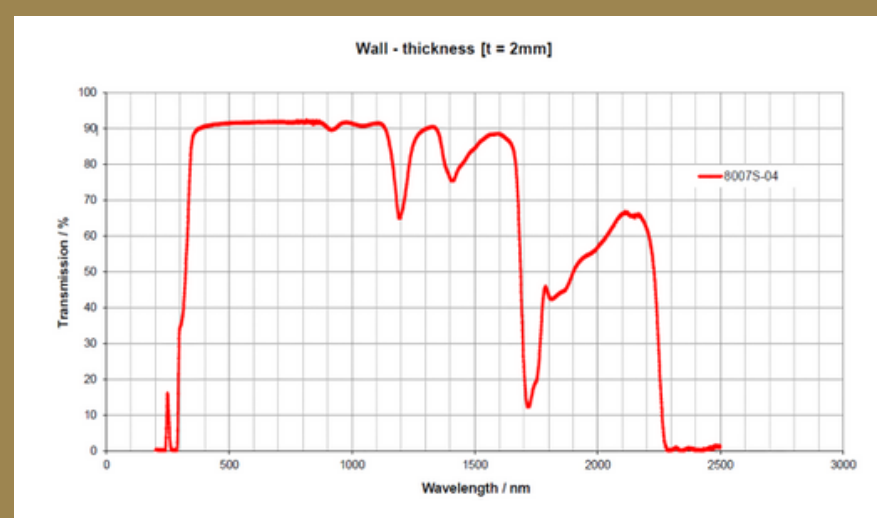
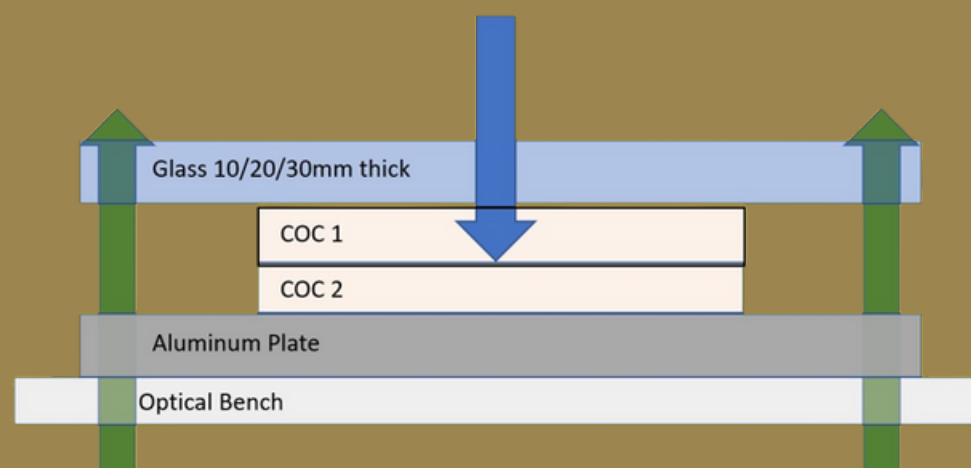
Lithography of channels [2]



Sealing of cartridges for immunoassays[3]

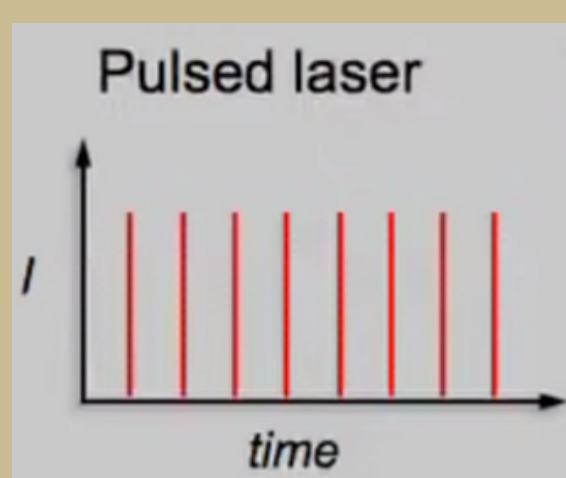
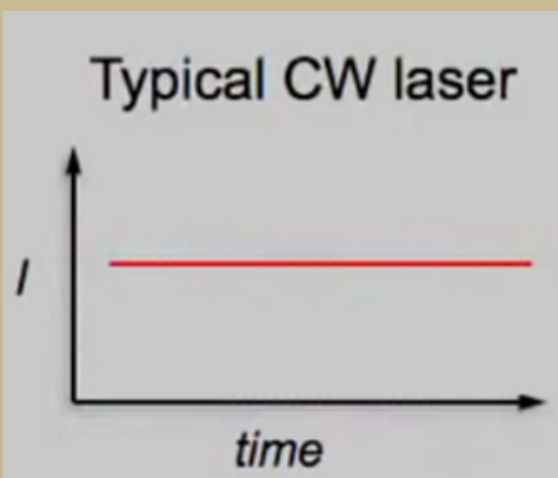
CHALLENGES

- **Welding of dark/absorptive polymer is relatively easier.**
- **The challenge arise with transparent polymers**
- **In this modern day and age transparent microfluids are preferred for better imaging and diagnostics.**
- **To get around this problem a special phenomenon in lasers can be exploited. This is called two-photon absorption or non-linear absorption.**



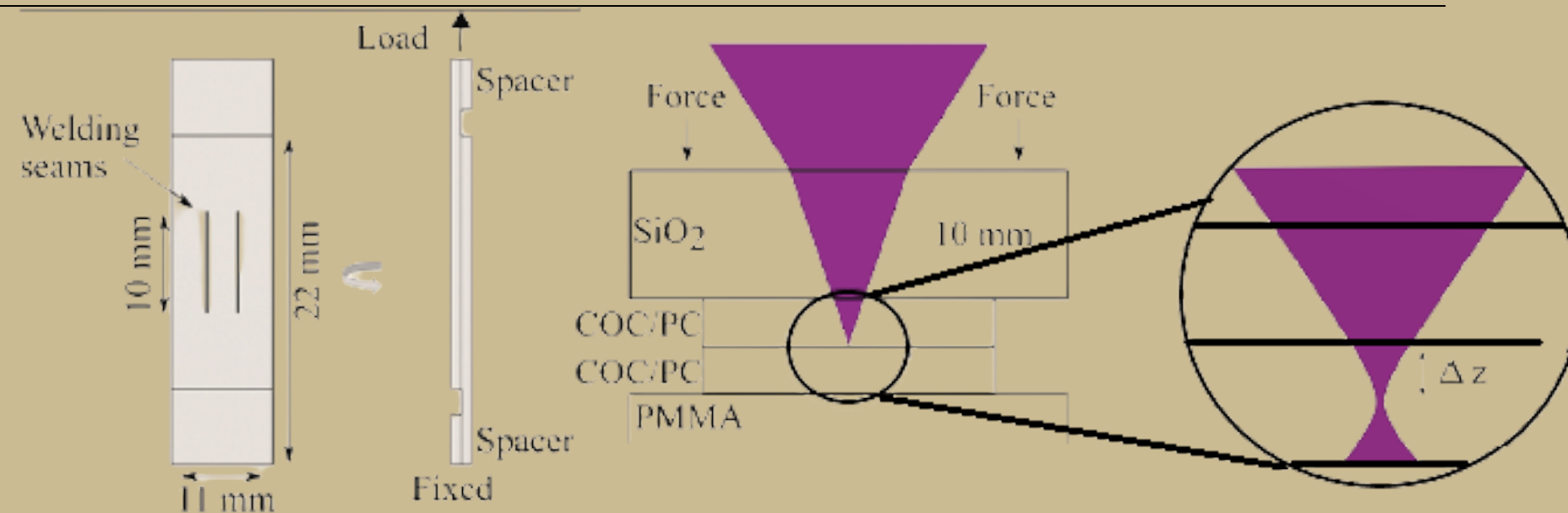
WHAT'S NEW!

- One step process for complete fabrication of point-of-care devices
- Such devices are used as diagnostic tools
- As the percentage of aging population increases-Healthy aging counts
- Move from reactive medicine to preventive diagnostics



OUTLOOK

- Use pulsed laser to get high peak but normal average power.
- Ensuring that at the focus of the laser there is always heat generation.
- If the focus is at the interphase of the two polymer surfaces then there would be successful welding.
- The same laser can be used for channel formation, cutting and sealing. Reducing the production time



Scan to know more about me...

