

# Monitoring of Different pH Buffer Solutions' Interaction in Micro Flow Channels Fabricated by PolyDiMethylSiloxane

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## 1. Introduction

Viscoelastic material PolyDiMethylSiloxane (PDMS) is one of emerging candidates for the fabrication of Microfluidic Chip (MC) in micro scale for a wide range of applications in biological and medical research. So, PDMS is used as one of the most frequent materials for the formation of inexpensive MC with different microfluidic channels due to its excellent properties of optical transparency, easy and swift fabrication process, chemical inertness and low shrinkage rate with the replication of mold into micro-scale environment. Moreover, CAD designed 3D printed structure to fabricate replica mold of MC using PDMS eliminated the necessity of using expensive clean room facilities with time consuming fact.

In our research group, a Terahertz Chemical Microscope (TCM) [1, 2] has been proposed and developed for the visualization and measurement of chemical and biological reactions in detail with Terahertz (THz) image sensing method. Our prototype measures the amplitude of THz waves which is radiated from Sensing Plate. When chemical reactions due to the interaction of different fluid flow solutions through microfluidic channels occur onto the Sensing Plate, the electric potential changes at the surface of Sensing Plate and the amplitude of THz waves change as well.

In this paper, we measured the interactions of two pH buffer solutions through our designed micro flow channels with the captured THz images within TCM system.

## 2. Experimental Set Up:

A Sensing Plate was fabricated as a part of using sensor of chemical materials. The Sensing Plate consists of SiO<sub>2</sub> and Si film on a Sapphire substrate. When femtosecond laser pulses are irradiated into the bottom surface of the Sensing Plate through sapphire substrate, THz waves are generated from the Si-layer in the Sensing Plate. The reason behind it is to form a depletion layer naturally into the Si-layer. Depending on the electrical potential at the surface of Sensing Plate, magnitude of depletion region is formed. Depending on the magnitude of depletion field, the amplitude of the radiated THz waves is determined. Thus, interaction of two different concentrations of pH buffer solutions through microfluidic channels is connected to the electric potential on the Sensing Plate and such interaction of concentrations of different pH solutions is able to be visualized by meas-

uring the amplitude of radiated THz waves. For the formation of PDMS, cross-linked two agents of Sylgard 184 Silicone elastomer base agent and Sylgard 184 Silicone elastomer curing agent as an adhesive were mixed in a ratio of 10:1 respectively. Then 3D designed structure containing micro flow channels of MC was printed by 3D printer and the cross-linked solution was poured into that printed structure to prepare replica mold of PDMS. It was then put into the oven for 24 hours in a controlled 40 degrees Celsius. When it became hard enough, it was ready to use as a PDMS designed MC for the experiment.

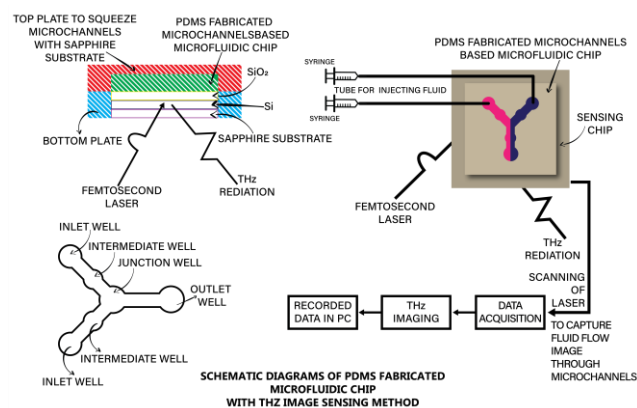


Fig.: Sensing Plate formation with microfluidic channels fabrication including entire THz Imaging system.

## 2. Result:

We successfully fabricated microfluidic channels in micro scale integration using PDMS with capillary tube design concept. Then flow of different viscous pH buffer solutions through micro-channels were captured in the form of THz images. It was also analyzed, calculated different parameters [3, 4] of the fluid dynamics of such viscous solutions by considering the fluid flow properties [3,4] within microfluidic environment.

## References

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