

Microwave Heating in Microfluidic Devices

Lori Sandberg¹, David Issadore², Robert Westervelt²

¹University of Wyoming, ²Harvard University

A devices to rapidly and locally heat drops of fluid with microwave power in microfluidic devices was developed. The devices were made using soft lithography—a method to print micrometer sized fluid channels on polymer molds. A mixture of water droplets and oil travel in a channel between two metal-filled electrodes (see **Figure 1**), which connect to a microwave source. The water strongly absorbs the microwave power but the polymer mold, glass, and oil do not. The energy from the microwaves heats the water droplets. The water droplets entering between the electrodes will be at room temperature and are heated by about 15°C (see **Figure 2**). The droplets lose their heat to the oil bath after exiting the electrode channels. The drops are too small to use a thermometer to tell their temperature so nanoparticles with temperature dependent fluorescence are placed in the water droplets. The intensity of the fluorescence decreases when the particles are heated. This method of rapid heating could be used in polymerase chain reaction (PCR) to duplicate DNA.

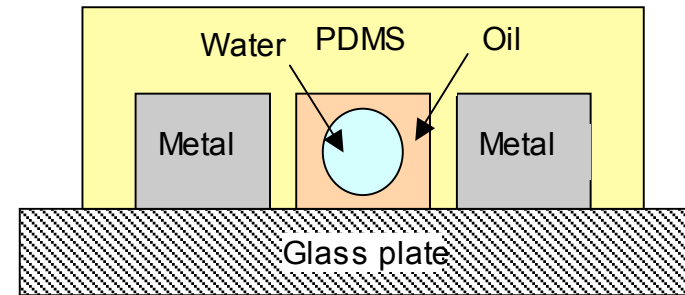


Figure 1: The water and oil mixture flow through a channel in the Polydimethylsiloxane (PDMS) which is bordered by two tunnels of metal.

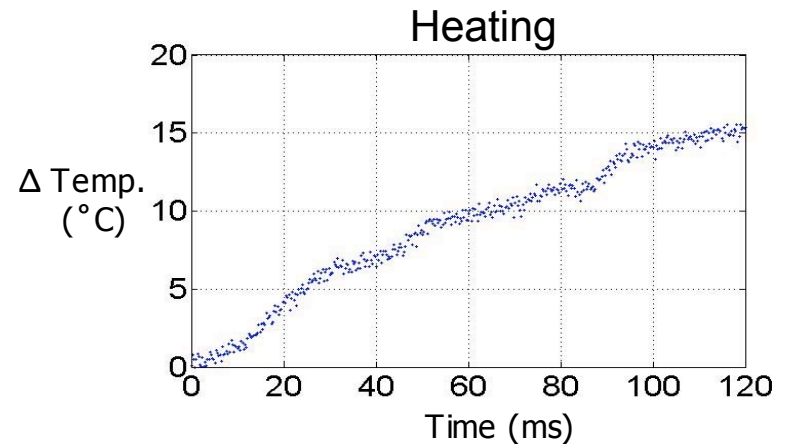


Figure 2: The water droplets are heated as they flow through the electrodes.

Supported by NSF PHY-0117795