

Microfabricated Valveless Devices for Thermal Bioreactions based on Diffusion-limited Evaporation

Supplementary Information

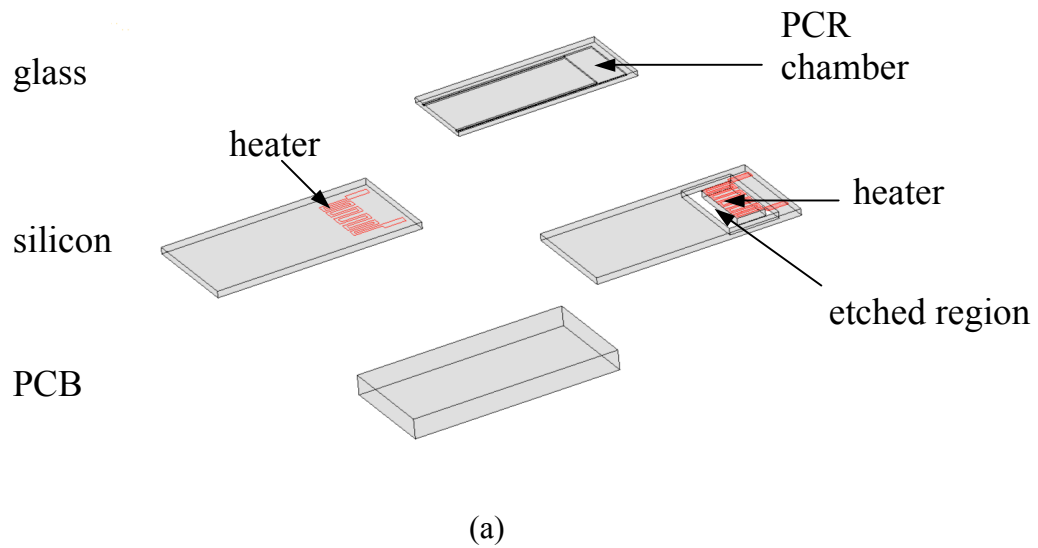
Fang Wang,^{†a} Ming Yang,^{†a} and Mark A. Burns^{*ab}

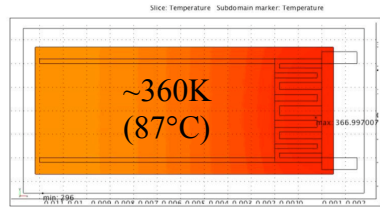
^aDepartment of Chemical Engineering, University of Michigan, Ann Arbor, MI 48109

^bDepartment of Biomedical Engineering, University of Michigan, Ann Arbor, MI 48109

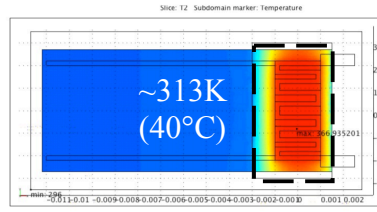
^{*}Email: maburns@umich.edu; Fax: (734) 763 0459; Phone: (734) 764 4315

Supplementary Figure 1 (a) The heat transfer model of the valveless devices. All three parts (glass, silicon and PCB) are 14mm long and 7mm wide. Both glass and silicon substrates are 500 μm thick, and PCB is 1.5mm thick. The heater is set at a constant heat flux for a given temperature in the reaction chamber (94°C, 55°C and 72°C). The etched region that is 1mm wide is treated as air chamber. The temperature at the bottom surface of the PCB is set at room temperature (23°C). Natural convective heat transfer boundary conditions are applied to all the other surfaces with a heat transfer coefficient of 10 $\text{W}/\text{m}^2\cdot\text{K}$. (b)-(g) Simulation results of temperature distribution with reaction chamber temperature at 94°C, 72°C, and 55°C. (b)-(d): a long-armed device without thermal isolation; (e)-(g): a long-armed device with thermal isolation. The dash lines show the outer boundaries of the diaphragms.

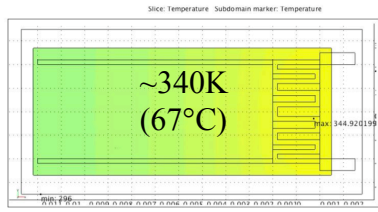




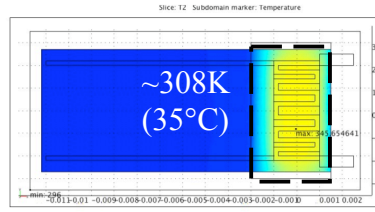
(b)



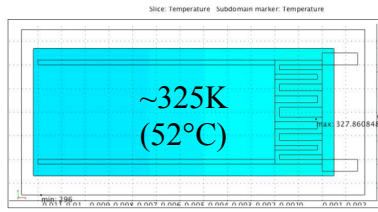
(e)



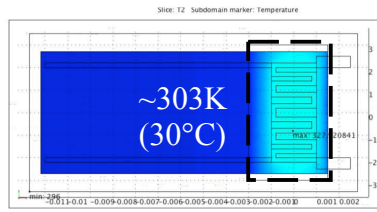
(c)



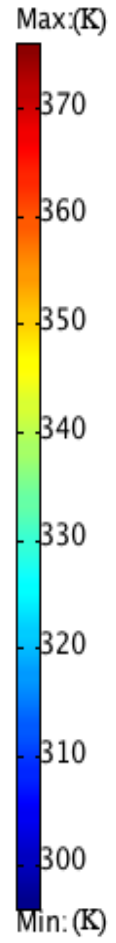
(f)



(d)



(g)



Supplementary Figure 2 Temperature along the length of the reaction chamber for two designs: chamber on silicon while surrounded by a diaphragm, and chamber directly on a diaphragm.

