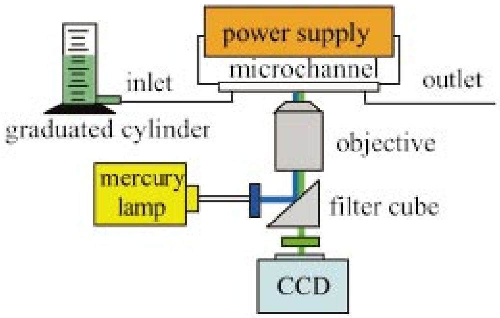
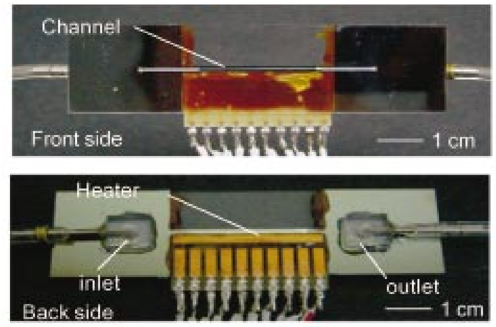
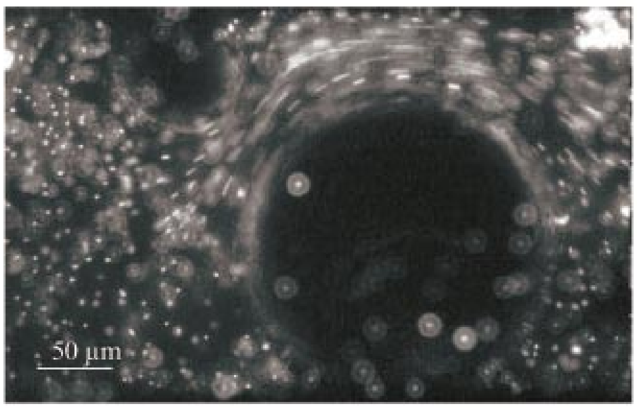


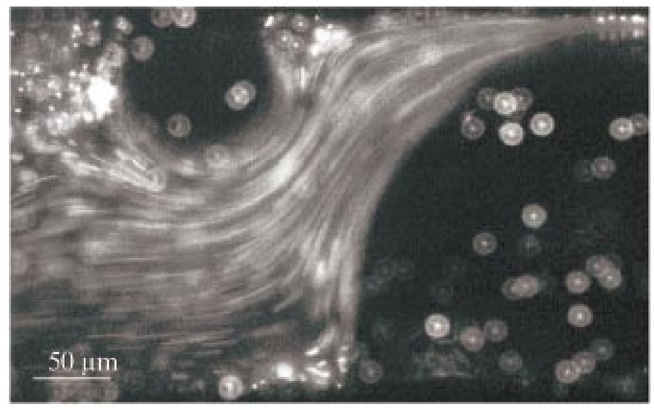
(a) Experimental setup



(b) Microchannel with integrated heater



(c) P = 1.2 W



(d) P = 1.4 W, 56 ms later

Nucleation and Growth of Vapor Bubbles in a Heated Silicon Microchannel

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Flow visualizations of boiling in a heated 270 µm wide by 95 µm deep microchannel are presented. The inlet liquid flowrate is 0.2 µl/min, and the fluorescent seed particles are 700 nm diameter polystyrene spheres. The schematic of the experimental rig is shown in (a), which includes an epi-fluorescent microscope, a 20 X objective (0.75 numerical aperture), and a 12-bit resolution interline CCD camera. An anodically bonded glass cover slide provides optical access to the microchannel shown in (b). Aluminum heaters are sputtered onto the back side of the silicon chip. Two nucleated vapor bubbles on the side walls are captured in (c) and (d) with 1 ms exposure times. Power is increased from 1.2 to 1.4 W, increasing the vapor volume and consequently accelerating the liquid in (d). The images show particle pathlines between the two bubbles. The image focal plane is approximately 20 µm from the inner surface of the glass cover slide. Some particles adsorb onto the walls at the onset of partial dry-out.