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Polymer mold fabrication for biomimetic circular microstructures

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Abstract

Curved or circular cross-section have many advantages over rectangular cross-section microchannels. It can mimic biological glands and vessels more closely, be used for biomolecules culturing more effectively, and be used for fluidic structures such as nozzles or valves more efficiently. I would like to present a couple of methods to create these circular cross-section microchannels using thermal air expansion, and compressed gas expansion with polydimethylsiloxane (PDMS). We have created a wide variety of circular microchannels with diameters ranging from 25 to 500 μm. The dimension can be controlled by starting mold dimensions, applied gas pressure, and gelation time of the partially cured PDMS. The process provides a simpler and more accurate solution than other circular microchannels fabrication techniques, not requiring plasma-activated bonding or careful alignment processes. I will introduce our work in using this technique for investigating arterial thrombosis and making novel microneedles.

Short Bio

Woo-Tae Park is currently an associate professor at Seoul National University of Science and Technology (Seoul Tech), working on fundamental and applied research in micro/nano devices used for biomedical applications. He received the B.S. degree in mechanical design from Sungkyunkwan University, Seoul, Korea, in 2000, the M.S. and Ph.D. degrees in mechanical engineering from Stanford University, Stanford, Calif, USA, in 2002 and 2006 respectively. For his graduate degree work, he worked on optical measurements for electrical contact deformation, wafer scale encapsulated MEMS devices, and submillimeter piezoresistive accelerometers for biomedical applications. The research was conducted under the guidance of Prof. Thomas W. Kenny. After graduation, he started as a senior packaging engineer at Intel Corporation, designing silicon test chips for assembly, test, and reliability. He then went to Freescale Semiconductor, leading several projects on MEMS process development in the Sensor and Actuator Solutions Division. After 4 years of industry experience, Woo-Tae moved to Institute of Microelectronics (IME) at Singapore, where he started as MEMS designer, and then got promoted to project leader, and eventually group leader (principle investigator). At IME, Woo-Tae worked on implantable biomedical MEMS sensors systems and wireless neural probes.