Characterization of QSil 216 and QSil 218 for Microfluidic and Biomedical Applications

J.K. Mika, R.M. Mayer, H.D. Wanzenboeck, E. Bertagnolli
Institute for Solid State Electronics, Vienna University of Technology, Vienna, Austria
heinz.wanzenboeck@tuwien.ac.at

During the last two decades microfluidic technology greatly enhanced due to the large areas of application for microfluidic devices. In contrast to early classical applications like mixers, nozzles and pumps the rising field of biomedical applications like cell testing systems, lab-on-chip devices require also progress in new fabrication methods and materials. Polydimethylsiloxane is a material widely used in biomedical applications. Currently, Sylgard 184 is taking the dominant role as material for micro- and nanofluidic devices while other siloxanes are also available. Here, we compared for the first time two alternative materials QSil 216 and QSil 218 with Sylgard 184 by using them for the fabrication of a neurite-isolation microfluidic device (Figure 1).

Microfluidic devices for nerve cells made of QSil 216 and QSil 218 were fabricated and differences in the fabrication process and material properties were investigated: (i) To ensure the same cell culture reservoir height the thickness as a function of spin speed was evaluted. (ii) Furthermore, to provide the same channel dimensions for the neurites the shrinkage rate at different curing temperatures were determined (Figure 2). (iii) To ensure the hydrophilicity of the microchannels to avoid air bubbles the contact angle of every material as a function of time was observed. (iv) Intended for optical fluorescent measurements the optical transmission spectra of every material was measured. Finally, to validate the biocompatibility of the materials CaCo-2 cells into reservoirs and observed the different amount of cells after three days of growing (Figure 3).

Based on the results of our investigations we fabricated microfluidic devices out of each material and seeded nerve cells in it. The results clearly indicated that both QSil 216 and QSil 218 can be used as alternative material for Sylgard 184 for microfluidic devices and biomedical applications although Sylgard 184 showed higher hydrophilic stability and both of the used QSil subtypes indicated a better optical transmission in the optical UV-VIS spectra.

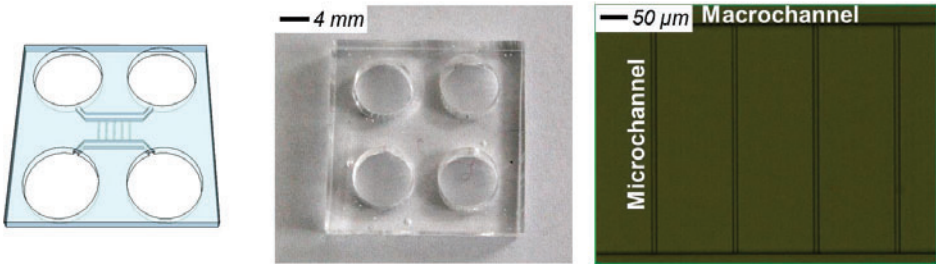

Figure 1: Neurite-isolation microfluidic device.

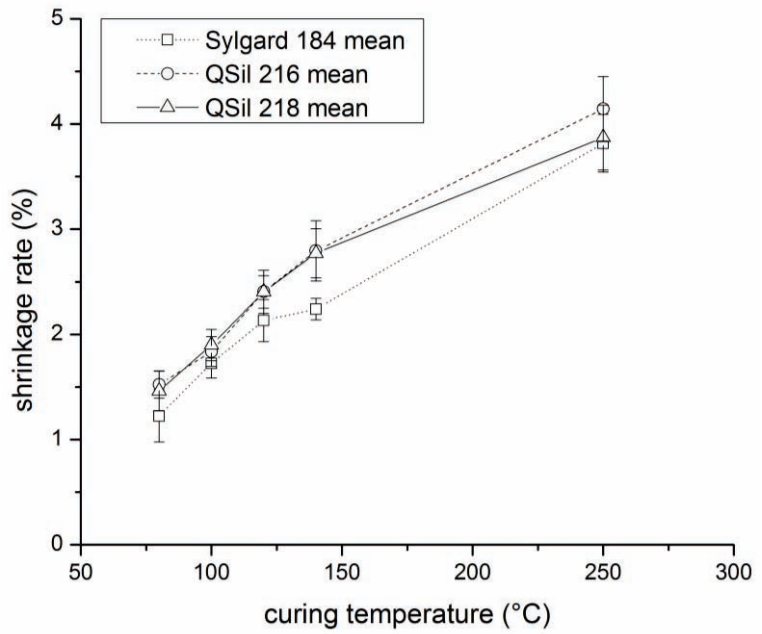

Figure 2: Shrinkage rate for the specified materials at different curing temperatures.

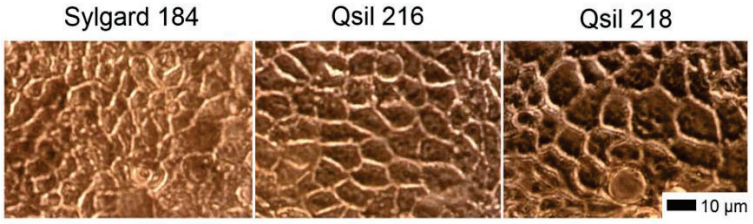

Figure 3: Biocompatibility determination using CaCo-2 cells: To identify differences in viability, growing and adherence the same amount of CaCo-2 cells were seeded in reservoirs entirely made of either Sylgard184, QSil216 or QSil218. Picture taken after 4 days of seeding, showing a confluent cell layer.