Adjustment of Surface Properties of Microfluidic Chips Using Nanoparticles

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The development of microfluidics is necessary for many reasons, especially in bio-medicine, where it would help to save time and resources such as the amount of chemical precursors as well as to reduce the chemical wastes made after the laboratory analysis in the medical testing process. This research showed how to improve the efficiency of microfluidic chips by changing the surface properties and supplementing the material with low amounts of superhydrophilic nanoparticles. Three-dimensional structures with open microchannels were made out of commercial photo-polymer using a stereolithographic 3D printer. The row material was supplemented with different amounts of commercial superhydrophilic silica nanoparticles. To demonstrate the efficiency of the proposed method, the contact angle between a water droplet and the surface was measured using professional lab equipment. It was demonstrated that even low amounts of nanoparticles (below 1%) can reduce the contact angle from 120 degrees to 50 degrees. The water droplets in the channels of the control model didn't advance at all, while the hydrophilic chips performed way better and the water droplets easily reached the other end of the channel. Thus, the measurements made, showed that the hydrophilic chip achieved its goal. This study showed that by using physical methods, instead of chemical treatment, one can solve the hydrophobicity problem by supplementing the material composition with very low amounts of SiO_2 super hydrophilic nanopowder. Although the surface properties of the material were dramatically changed, other properties such as optical or mechanical ones of the photo-resin were not affected.