Morphological surface structures can significantly modify wetting properties of materials. Here, using a direct femtosecond laser nano/microstructuring technique, we created a capillary surface structure on Ti90/Al6/V4 alloy, which generates an extremely strong capillary force. A water placed on the created material rapidly spreads over the surface, forming a thin film with a contact angle close to zero. The capillary force is so strong that water is capable of running vertically uphill against the gravitational force. The produced surface structure is an array of parallel microgrooves, the surface of which is textured with nanostructures. To fabricate this capillary surface structure, we used a femtosecond laser system that generates 100 fs pulses with energy of 7 mJ at a pulse repetition rate of 1 kHz. For characterizing capillary action of the created surface, we study water spreading dynamics on vertically oriented surface using video recording. Our study shows that water spreading dynamics against the gravity follows Washburn’s square root of time dependence. Potential applications of the unique capillary properties of the created material include solar steam generation, liquid-vapor phase-change cooling devices, lab-on-chip technologies, microfluidics, and fluidic microreactors.

Keywords: Surface nano/microstructtures, Capillary surface, Femtosecond laser

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