Tech Science Press

ICCES, 2024, vol.29, no.3
DOI: 10.32604/icces.2024.011320

PROCEEDINGS

3D Printing of Overhanging Microstructures for Tunable Liquid Wettability

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ABSTRACT

Surfaces with overhanging microstructures play an essential role in surface wettability. Typically, surfaces with tightly-distributed multiply symmetric re-entrant microstructures enable the liquid suspension toward water, oil, and even *n*-perfluorooctane, whose surface tension is as low as 12.0 mN/m [1-4]. In contrast, surfaces with asymmetric re-entrant microstructures are favorable for unidirectional liquid spreading, where the liquids exhibit a small contact angle on the surfaces [5]. These fantastic wettability behaviors can be attributed to three-dimensional (3D) features of the overhanging microstructures, where the edge effect and Laplace pressure difference are generated on the overhanging microstructures. Based on these re-entrant microstructures, multiple functions have been realized. One typical example is the ultra-wide-angle transport based on asymmetric re-entrant microstructures, which can achieve high transport efficiency and programmable forward/lateral transport paths simultaneously. Herein, the wetting mechanisms behind these overhanging microstructures are discussed, and the intricate microstructures are constructed by 3D/4D printing techniques based on two-photon polymerization (TPP) and digital light processing (DLP). The TPP-based 3D/4D printing enables the manufacturing of 3D parts with sub-micrometer resolution but at a low speed, while the DLP-based 3D/4D printing enables the manufacturing of 3D parts at a relatively high speed but with sub-millimeter resolution. Therefore, the printing technique is carefully selected to fabricate the target surfaces for tunable liquid wettability.

KEYWORDS

Overhanging microstructures; re-entrant microstructures; two-photon polymerization; digital light processing; wettability

Funding Statement: X. L. acknowledges the support of the Start-up Research Fund of Southeast University (RF028623292). K. Z., and X. L., acknowledge the support of the National Research Foundation, Prime Minister's Office, Singapore under its Medium-Sized Centre funding scheme through the Marine and Offshore Program. K. Z. and X. L. acknowledge the RIE2020 Industry Alignment Fund–Industry Collaboration Projects (IAF–ICP) Funding Initiative, as well as cash and in-kind contribution from the industry partner, HP Inc., through the HP-NTU Digital Manufacturing Corporate Lab. Z. G. acknowledges the support of the national Natural Science Foundation of China (52033002).

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.

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