Prof. Bo Chang

Shaanxi University of Science and Technology

Title:

Low-cost Laser Micromachining Super Hydrophilic - Super Hydrophobic Microgrooves for Capillary Micromanipulation of Microfibers

Abstract:

Microfibers are important components for manufacturing fiber reinforced materials, and their orientation has a significant impact on their mechanical, electrical, and thermal properties. However, in the micro world, the adhesion force dominates gravity due to the scaling law, making accurate micromanipulation of the microfibers challenging. Methods for micromanipulation of fibers includes electrospinning, 3D printing, robotic micromanipulation, microfluidics, and so on. Despite of the abundance of available methods, precisely controlling the spacing and orientation of microfibers remains a challenge hampering the construction of complex patterns from microfibers.

This work suggests a simple and low-cost laser micromachining method for fabrication of super hydrophilic-super hydrophobic grooves for capillary self-alignment of microfibers. We investigated key manufacturing parameters and its effect on the sizes and wetting properties of the microgrooves. We studied the influences of the width (20 μm - 100 μm), the depth (8 μm – 36 μm) on the volume of water droplet confined inside the grooves. The results reveal that the groove's width and depth are proportional to the number of scanned lines and scans, respectively. We further demonstrated that by adjusting the scanning speed of a de-focused laser beam, we can change the microgrooves' wetting properties from 10° to 120°. We demonstrated that diverse types of microfibers,

including both natural and artificial microfibers, can self-align to super hydrophilic -super hydrophobic microgrooves. The results suggest that super hydrophilic – super hydrophobic microgrooves have great potential in microfiber micromanipulation applications such as natural microfiber categorization, fiber-based microsensor construction, and construction of fiber-enforced material.

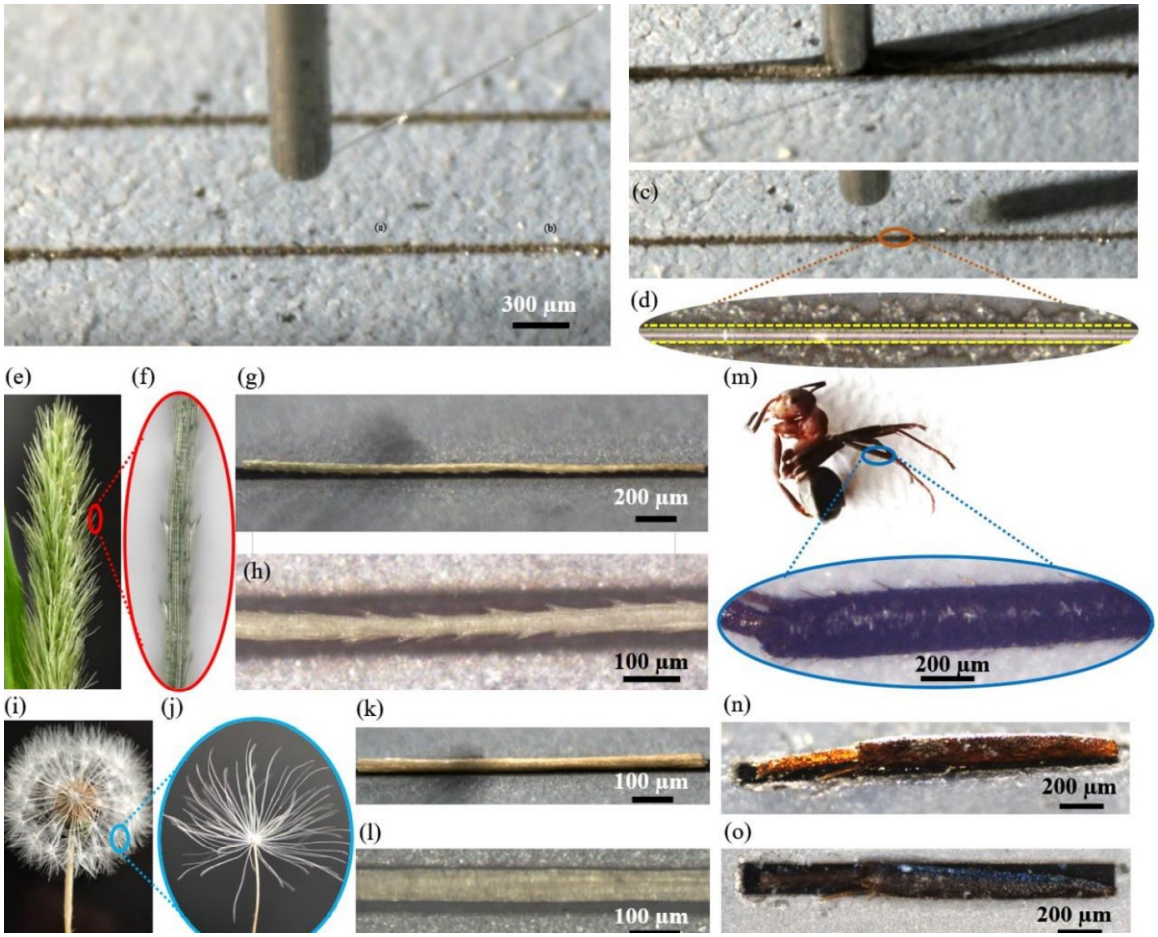

Fig. 1 Demonstration of capillary self-alignment of different types of microfibers on shape matching super hydrophilic – super hydrophobic grooves.

Biography :

Dr. Bo Chang received the M.S. degree in automation technology from Tampere University of Technology, Finland, and the Dr. Tech. degree in electrical engineering from Aalto University, Finland.

From 2013 to 2016, Dr. Bo Chang was a Finnish Academy Postdoctoral Researcher with the Robotic Instruments Laboratory, Aalto University, Finland. In 2014-2016, she was a

Visiting Scholar at the Division of Microsystem Technology, Uppsala University, Sweden. Since 2017, she has been a Professor with the School of Mechatronics Engineering, Shaanxi University of Science and Technology. She was nominated as Shaanxi Hundred Young Talents in 2017. She is leading the Multiscale Mechatronics Research group.

Dr. Bo Chang has authored or co-authored more than 50 publications in international scientific journals and international conferences, in the field of micromanipulation and microfabrication. Dr. Bo Chang also has long experiences of international research projects, including EU Project HYDROMEL, a cooperative project on combining robotic methods and self-assembly for micro- and nano scale components, with 24 partners from 11 European countries, and FAB2ASM, a cooperative project on 3D integration and optoelectronics, with 9 partners from 6 European countries. National research projects Dr. Bo Chang has participated or was PI include projects supported by Academy of Finland (AKA), Finnish Funding Agency for Technology and Innovation (TEKES), National Natural Science Foundation of China (NSFC).

Dr. Bo Chang's current research interests include robotic microassembly, self-assembly, micromanipulation, micro robots, microfabrication and applications.