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Direct Laser-written on PDMS Enables Efficient Antifouling Ability

Wanqing Dai[1] and Jian Lin Chen[2]
[1, 2] Department of Applied Science, School of Science and Technology, Hong Kong Metropolitan University, Kowloon, Hong Kong SAR, China

Fouling is a growing concern for the utilization of polydimethylsiloxane (PDMS) in various fields, particularly in microfluidics, due to its impact on surface properties. In this study, we demonstrated that using a CO2 infrared laser directly onto PDMS surfaces that formed a clustered multilayer structure comprising glassy carbon under ambient conditions. This structural configuration imparted PDMS surface with a fouling resistance property. Laser power, speed, frequency, and pulse density all contribute to the resistance of the laser to surface fouling. The surface antifouling ability exhibited an 89.8% improvement over that observed in pure PDMS under the optimized parameters. Augmenting the number of laser repetitions could effectively enhance the surface fouling resistance of PDMS. It was observed that a higher number of laser passes enhanced the fouling resistance of the surface by 94.5% when the number was increased to three times. However, a subsequent increment to four times led to a decline in surface fouling resistance. The results of Raman and XPS revealed a substantial increase in the carbon content on the PDMS surface after three laser repetitions, resulting in complete surface blackening. Subsequently, the determined optimal laser settings were applied to the microfluidic channel constructed with PDMS, yielding favorable long-term fouling resistance. In conclusion, this study showcases the favorable antifouling properties achieved through direct laser writing on PDMS surfaces, highlighting its potential for microfluidic applications.

Biography:

I obtained my MA degree from Wenzhou University in 2021 and I am currently pursuing a PhD at Hong Kong Metropolitan University. My research focuses on investigating antifouling strategies for microchannel interfaces. I have a keen interest in interdisciplinary fields that intersect microbiology, materials science, and microfluidics.