Development of A Nano-textured SUS316 Superhydrophilic Coating for Protein Capturing in Medical Applications

Pak-Man Yiu1*, Yu-Sheng Hsiao2, Jinn P Chu2 and Meng-Yi Bai3

1Department of Materials Engineering, Ming Chi University of Technology, New Taipei City 243303, Taiwan 2Department of Materials Science and Engineering, National Taiwan University of Science and Technology, Taipei 106335, Taiwan 3Graduate Institute of Biomedical Engineering, National Taiwan University of Science and Technology, Taipei 106335, Taiwan

***Corresponding author:** pmyiu@mail.mcut.edu.tw

Abstract

Extreme surface wetting property, for example super-hydrophilicity, can be obtained by creating a surface nanostructure [1]. Yet a controversial consequence is that when these surfaces were exposed to air, a carbonaceous and organic layer will be rapidly adsorped. As this layer grew thick with time, hydrophilicity of the surface was gradually compromised. Such phenomenon is sometimes referred as hydrophilic aging. For example, in our previous work aging could drastically increase the water contact angle from ~17◦ to 99◦ in 22 days [2]. Recently we have turned this shortcoming into an advantage by applying the coating on a microfluidic channel, which is designed for capturing proteins. Testing with bovine serum albumin (BSA) protein resulted in a maximum capture efficiency of SS (72.58%). On the other hand, we had discovered that the lost hydrophilicity can be restored by atmospheric plasma jet (APPJ). APPJ is believed to be capable of cleaning the adsorbed carbonaceous layer and thus exposing the hydrophilic surface again, which guaranteed the reusability and sustainability of our coating. SUS316 is always well-known as a biocompatible material. Therefore, our nano-textured SUS316 coating can be a potential material for medical applications, such as surface modification of implants and biosensing.

Keywords: Physical vapor deposition, Hydrophilic, Atmospheric plasma, Biocompatible material

CURRICULUM VITAE

Name:	Pak-Man Yiu
Academic positions:	Assistant Professor
Workplace:	Center for Plasma and Thin Film Technologies
Address:	84 Gungjuan Rd., Taishan Dist. New Taipei City 24301, Taiwan
Email:	pmyiu@mail.mcut.edu.tw
Expertise:	Thin film deposition and processing, Surface properties

Education History

[Doctorate]	2013-2016	Department of Physics and Materials Science, City University of Hong Kong
[Master]	2010-2012	Department of Materials Science and Engineering, National Taiwan University
[Bachelor]	2007-2010	Department of Physics and Materials Science, City University of Hong Kong

Professional Background

2019-2022	Assistant Professor, College of Engineering, National Taiwan University of Science and Technology
2017-2019	Postdoctoral fellow, Department of Physics, Hong Kong University of Science and Technology

Selected Awards and Honors

1. 2024 Technology Innovation Award (Gran Prix), KAIST
2. 2019 Academic Excellence Award, Korean Society for Biotechnology and Bioengineering
3. 2013 Prime Minister's Award, Republic of Korea
4. 2012 Scientist of The Month Award, Republic of Korea

Selected Publications

1. J. Jang, S. Joo, J. Yeom, Y. Jo, J. Zhang, S. Hong, C. B. Park "Lateral piezoelectricity of Alzheimer's Aβ aggregates" *Advanced Science*, vol. 11, pp. 2406678, 2024
2. C. H. Lee, J. Kim, C. B. Park "Z-Schematic artificial leaf structure for biosolar oxyfunctionalization of hydrocarbons" ACS Energy Letters, vol. 8, pp. 2513-2521, 2023
3. J. Kim, J. Jang, T. Hilberath, F. Hollmann, and C. B. Park "Photoelectrocatalytic biosynthesis fuelled by microplastics" *Nature Synthesis*, vol. 1, pp. 776-786, 2022
4. J. Yoon, H. Jang, M-W Oh, T. Hilberath, F. Hollmann, Y. S. Jung, and C. B. Park. "Heat-fueled enzymatic cascade for selective oxyfunctionalization of hydrocarbons" *Nature Communications*, vol. 13, pp. 3741, 2022
5. J. Jang and C. B. Park. "Magnetoelectric dissociation of Alzheimer's β-amyloid aggregates" *Science Advances*, vol. 8 (issue 19), pp. eabn1675, 2022