

Surface Plasmon Resonance Imaging: A Novel Visualization for Phase Change Phenomena

Seong Hyuk Lee¹, Hae-Jin Choi¹, Jooheon Kim²

¹School of Mechanical Engineering, Chung-Ang University
84, Heukseok-ro, Dongjak-gu, Seoul 06974, Republic of Korea

First. shlee89@cau.ac.kr; Second. hjchoi@cau.ac.kr

²School of Chemical Engineering, Chung-Ang University
84, Heukseok-ro, Dongjak-gu, Seoul 06974, Republic of Korea

Third. Jooheonkim@cau.ac.kr

Extended Abstract

Surface Plasmon Resonance (SPR) is a highly sensitive optical phenomenon that occurs at the interface between a metal (typically gold or silver) and a dielectric medium (such as air or liquid) [1-3]. It enables precise detection of refractive index changes, making it a powerful tool in biosensing, materials science, and interfacial studies. Based on this principle, Surface Plasmon Resonance Imaging (SPRI) provides a real-time visualization method for analyzing interfacial phenomena at the nanoscale. The SPRI is expected to offer a novel approach for investigating complex interfacial behaviors, enhancing our understanding of phase change dynamics, and driving advancements in practical applications across various fields, including thermal management, microfluidics, and surface engineering. This talk will introduce the fundamental concepts of SPR imaging and discuss their application in studying phase change phenomena, focusing on the in-situ visualization of evaporation, condensation, and frosting processes [4-5]. By capturing dynamic interfacial behaviors with high vertical resolution, the SPR imaging provides new insights into phase change mechanisms and nanoscale fluid dynamics.

References

- [1] H.J. Lee, C.K. Choi, and S.H. Lee, "Local heating effect on thermal Marangoni flow and heat transfer characteristics of an evaporating droplet", *Int. J. Heat Mass Transfer*, v. 195 p.123206, 2022.
- [2] H.J. Lee, C.K. Choi, and S.H. Lee, "Surface plasmon resonance imaging for analyzing the local variation of evaporation flux of multiple binary mixture droplets," *Int. Comm. Heat Mass Transfer*, v.146, p.106906, 2023.
- [3] H.J. Lee, C.K. Choi, and S.H. Lee, "Vapor-shielding effect and evaporation characteristics of multiple droplets," *Int. Comm. Heat Mass Transfer*, v.144, p.106789, 2023.
- [4] C.H. Jeong, H.J. Lee, C.K. Choi, and S.H. Lee, "Selective evaporation rate modeling of volatile binary mixture droplets," *Int. J. Heat Mass Transfer*, v. 178, p. 121584, 2021.
- [5] S. B-A, F. Long, J.S. Allen, C.H. Jeong, S.H. Lee, and C.K. Choi, "The effect of absorbed volatile organic compounds on the surface plasmon resonance measurement of ultrathin film in dropwise condensation," *Applied Sciences*, v. 10, no. 17, p. 5981, 2020.

Acknowledgements

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No.NRF-2021R1A2C3014510). This research was also supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (NRF-2022M3H4A1A02076956).