Discharge physics of radiofrequency plasmas and its applications to the nanomaterial fabrication

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Radiofrequency (RF) plasma is being actively applied to processes for the fabrication of nanostructures. In this presentation, we briefly review the basic discharge characteristics of inductively coupled plasma (ICP) [1, 2], capacitively coupled plasma [1], and hybrid plasma (RF-biased ICP) [1, 3-6], which are the typical sources of the RF plasma. From these plasma sources, many different applications in terms of the fabrication of nanostructures are possible and thus, we will also present these kinds of the application-studies, such as atomic layer etching process [6], crystalline silicon quantum dots creation [7], carbon nano-structure fabrication [8], soft etching of two-dimensional materials [9], and etching of trench pattern under ion tilting [10].

References

[1] M.A. Lieberman, A.J. Lichtenberg, Principles of Plasma Discharges and Materials Processing, vol. 1, Wiley Inc, Hoboken New Jersey, 2005.)
[2] H. C. Lee, Appl. Phys. Rev. **5**, 011108 (2018).
[3] H. C. Lee, M. H. Lee, and C. W. Chung, Appl. Phys. Lett. **96**, 013511 (2010).
[4] H.-C. Lee and C.-W. Chung, Appl. Phys. Lett. **101**, 244104 (2012).
[5] H-C Lee, C-W Chung, J. H. Kim, and D. J. Seong, Appl. Phys. Lett. **115**, 064102 (2019).
[6] M-Y Yoon, H. J. Yeom, J H Kim, W Chegal, Y-J Cho, D-C Kwon, J-R Jeong, and H-C Lee, Phys. Plasmas **28**, 063504 (2021).
[7] D Choi, J H Kim, D C Kwon, C H Shin, H Ryu, E-J Yoon and H-C Lee, Nanoscale, **13**, 10356 (2021).
[8] D Choi, H.J. Yeom, K.H. You, J.H. Kim, D.J. Seong, E-J Yoon, H-C Lee, Carbon **162** 423 (2020).
[9] D Choi, D Kim, Y Jo, J.H. Kim, E-J Yoon, H-C Lee, TW Kim, Appl Surf Sci **565** 150521 (2021).
[10] M Y Yoon, H.J. Yeom, J H Kim, J-R Jeong, H-C Lee, Appl Surf Sci **595** 153462 (2022).