

Deposition of Carbonous Nanotips on Field Emitters

Fabian Hecht¹, Josef Sellmair¹, Philipp Buchner¹, Mathias Bartl¹, Matthias Hausladen¹, Rupert Schreiner¹

¹Faculty of Applied Natural Sciences and Cultural Studies, OTH Regensburg, D-93053 Regensburg, Germany

ABSTRACT

For efficient field emission electric fields in the range of 10^8V/m are required. Therefore miniaturisation of the field emitters can help to increase the efficiency of the devices, as well as the sharpness of the emitter tips leads to a specific local increase of the electric field (field enhancement) also increasing electron emission[1].

Based on the works of Yeong [2] and Nakahara [3], who grew extreme sharp carbon tips on metal emitters as for example tungsten emitters. Therefore, they used different organic gases to introduce carbon to the vacuum system. It was already known that thus grown sharp tips increased emission behaviour of the emitter cathodes. In our work we shifted the process to silicon field emitters and investigated their outcome current, stability and recoverability of the devices by growing carbon on degraded emitters. As shown in figure 1 the growth of the carbon nanostructures was documented by SEM imaging.

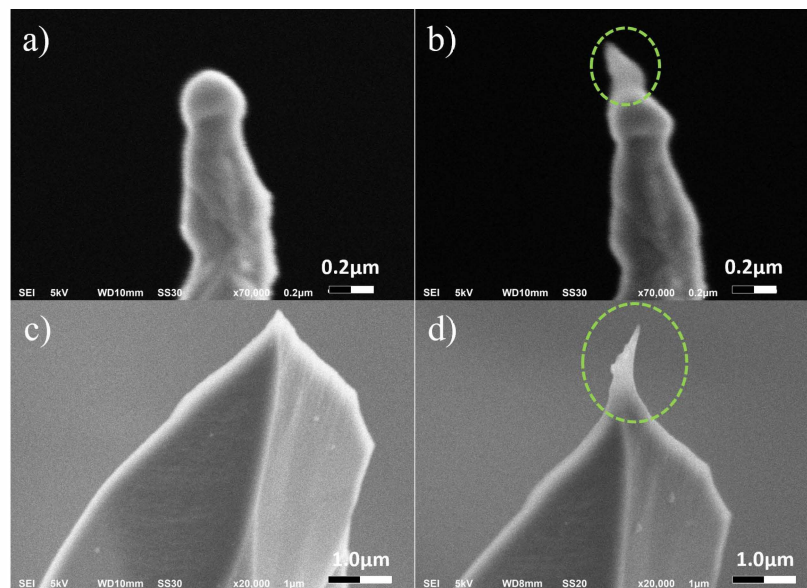


Fig. 1: a) Tungsten Emitter before and b) after Deposition; c) Silicon Emitter before and d) after Deposition

References

- [1] R. B. Marcus, K. K. Chin, Y. Yuan, H. Wang, and W. N. Carr, "Simulation and design of field emitters," *IEEE Trans. Electron Devices*, vol. 37, no. 6, pp. 1545–1550, Jun. 1990, doi: 10.1109/16.106255.
- [2] K. S. Yeong, C. B. Boothroyd, and J. T. L. Thong, "The growth mechanism and field-emission properties of single carbon nanotips," *Nanotechnology*, vol. 17, no. 15, pp. 3655–3661, Aug. 2006, doi: 10.1088/0957-4484/17/15/006.
- [3] H. Nakahara, S. Ito, S. Ichikawa, and Y. Saito, "Fabrication of Self-Aligned Nano-Structured Electron Emitters for Field Emission Scanning Electron Microscopy," *e-J. Surf. Sci. Nanotechnol.*, vol. 12, no. 0, pp. 192–196, 2014, doi: 10.1380/ejsnt.2014.192.