

Keep-in-Touch VIP meeting (October 19, 2021, 2.00pm)

The quest for deterministic direct plasma synthesis of nanostructures

Uroš Cvelbar

Jožef Stefan Institute, Ljubljana, Slovenia

Building 1D or 2D nanostructures like nanowires or nanowalls is important for numerous applications requiring large-scale nanomaterials production. Here, plasmas present a great opportunity since nanowires or nanowalls in plasmas are produced not only faster but in bulk quantities with high quality. These quantities are orders larger in quantity and time than any other comparing processing method available today. However, to master these processes in plasmas, understanding basic mechanisms underlying the growth of any nanostructure in plasma is extremely important. Moreover, it is also crucial to understand the growth mechanisms ruling in low-pressure and atmospheric-pressure plasmas compared to a high-temperature but thermally stable gaseous environment. Here, we have selected the direct plasma synthesis to study these mechanisms, where nanostructures are grown directly on exposed materials to only gaseous discharges. This is relevant especially for the design of metal electrode materials and plasmonic substrates. Extensive studies were performed for the oxidation and growth of metal oxide nanowires and nanowalls. The decade long quest for deterministic concepts of plasma synthesis for nanowire and nanowall growth will be presented with experimental evidence supported by developed theoretical models.

[1] Applied Surface Science, 2021, vol. 566, 150619, doi: 10.1016/j.apsusc.2021.150619.

[2] Nanomaterials, 2019, vol. 9, no. 10, 1405, doi: 10.3390/nano9101405

[3] Plasma sources science & technology, 2019, vol. 28, no. 8, 084002, doi: 10.1088/1361-6595/aae12e.

[4] Nanoscale, 2018, 18 pp., doi: 10.1039/C8NR06502K.

[5] Applied physics reviews, 2017, vol. 4, no. 4, 041302, doi: 10.1063/1.5007869.