# Selective Epitaxial Growth of ZnO Nanowires on (11-20) Sapphire

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ZnO nanowires are interesting objects for many applications in optoelectronics, photonics, energy harvesting, and more. In this work, we studied the localized growth of zinc oxide (ZnO) nanowires, using the so-called "selective epitaxial growth" technique. Starting with an array of holes etched into a dielectric SiN mask previously coated on a (11-20)-oriented sapphire substrate, nanowires are grown by MOVPE (metalorganic vapor phase epitaxy). As ZnO nucleation is unfavorable on the dielectric surface, adsorbed species mobility is used to localize the growth towards the substrate's exposed surfaces, i.e. the mask holes. Their diameter and the distance between holes are therefore two parameters to be adjusted for an efficient selective area deposition.

The SiN mask was fabricated using electron-beam lithography and reactive ion etching processes. ZnO nanowires were subsequently grown at high temperature (800-900°C) using DEZn and $N_2O$ precursors. Growth parameters were thoroughly studied : temperature, reactor pressure, O/Zn flux ratio, growth rate. The coating of ZnO shells on previously formed wires was also carried out. Once elaborated, the nanowire networks were observed by scanning electron microscopy. The selective epitaxy mechanism is compared with the deposition directly on sapphire substrates (i.e. without SiN mask). In both cases, ZnO nanowires with Zn-polarity are believed to emerge on the top of a O-polar piedestal.

a) b)

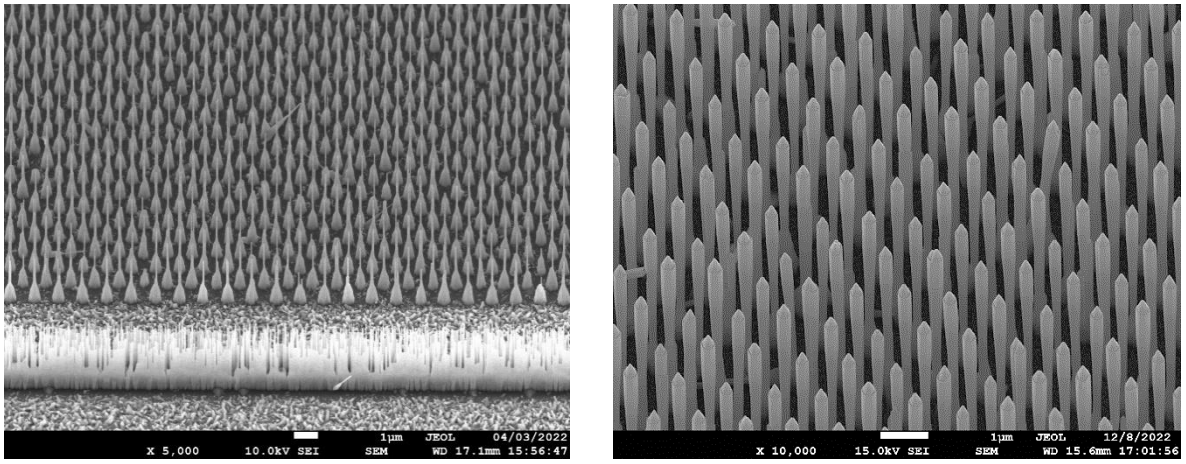


Fig.1. a) scanning electron microscopy image of the start of selective growth of ZnO nanowires on sapphire (hole diameter 50 nm, pitch 1 µm), and b) after coating with a ZnO shell.