

GROWTH AND STUDY OF SILICON NANOWIRES BY CATALYST ASSISTED LPCVD.

P. Gentile¹, F. Dhalluin³, P. Ferret², T. Baron³, T. David¹, K. Aissou³, D. Buttard¹
¹CEA-DRFMC, ²CEA-LETI, ³LTM-CNRS, Grenoble France.

Silicon nanowires (SiNWs) are promising materials for some of the basic building blocks in microelectronics (interconnects, transistor channel, nanoelectrodes, etc.) as well as the emerging application areas of photonics, chemical sensing, and solar cells.

Silicon nanowires (SiNWs) are grown on silicon (111) and (100) substrates in a Low Pressure Chemical Vapour Deposition (LPCVD) reactor. Silane is used as a reactive gas diluted in hydrogen. Catalysts are obtained by gold film dewetting or by colloidal gold deposition on silicon surfaces. With the dewetting method is difficult to obtain small diameter nanowires, typically less than 50 nm, to reach this dimension gold colloid is used. Experimental parameters such as growth temperature, SiH₄ partial pressure, and substrate orientation were investigated with different catalysts.. The temperature dependence of growth rate is measured in the 450°C – 700°C range, showing activation energy of 71 KJ/mole for NWs diameters between 50 and 500 nm. For NWs less than 50 nm we have observed that the NWs length are limited by increasing growth temperature. TEM and SEM are used to probe crystalline quality and shape of the SiNWs. TEM images are obtained on SiNWs dispersed on copper TEM grid. In a effort to add a higher level of organization to NWs growth, the metal catalyst was organised using the self-assembled properties of copolymer diblocks and porous alumina as a deposition mask.