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Controlled Growth of Charge Transfer Complex Nanowire by Physical Vapor Deposition Method Using Dielectrophoretic Force

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Abstract : In recent years, a variety of semiconductor nanowires (NWs) has been synthesized and used as basic building blocks for the development of electronic and optoelectronic nanodevices. Dielectrophoresis (DEP) has been widely investigated as a scalable technique to trap and manipulate polarizable objects. This includes biological cells, nanoparticles, DNA molecules, organic or inorganic NWs and proteins using electric field gradients. In this article, we have used DEP force to localize nanowire growth by physical vapor deposition (PVD) method as well as control of NW diameter on field assisted growth of the NWs of CuTCNQ (Cu-tetracyanoquinodimethane); a metal-organic charge transfer complex material which is well known of resistive switching. We report a versatile analysis platform, based on a set of nanogap electrodes, for the controlled growth of nanowire. Non-uniform electric field and dielectrophoretic force is created in between two metal electrodes, patterned by electron beam lithography process. Suspended CuTCNQ nanowires have been grown laterally between two electrodes in the vicinity of electric field and dielectric force by applying external bias. Growth and diameter dependence of the nanowires on external bias has been investigated in the framework of these two forces by COMSOL Multiphysics simulation. This report will help successful in-situ nanodevice fabrication with constrained number of NW and diameter without any post treatment.

Keywords : nanowire, dielectrophoretic force, confined growth, controlled diameter, comsol multiphysics simulation
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