Effect of grain size inside palladium nanowire grown by electrochemical method in hydrogen sensing

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With the increasing interest in nanoscale science and technology, NWs have been the subject of a great deal of research in the past decade. In the fields of chemical sensors, semiconductor and metallic NWs would be expected to improve the sensitivity, response time and power requirements in chemical sensors. In previous work, we developed a direct current assisted dielectrophoresis (DEP) process using floating electrode to create palladium (Pd) nanowire in predefined electrodes and demonstrated the hydrogen detections in the concentration range from 100 ppm to 2500 ppm due to nanogap bridging between the Pd grains. In this work, we demonstrated for the first time effects of grain size inside a single Pd NW in hydrogen sensing. The Pd NWs with the various grain sizes could be synthesized with the variation of DEP force, DC bias, and solution concentrations. In this work, it was for the first time found that hydrogen sensing mechanisms were changed from nanogap bridging mode to only resistance, variation mode as a function of Pd grain sizes. Based on emerging nanotechnology, this work will open a new way to improve total performance of hydrogen sensors.