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Semiconductor nanowires: Innovative control growth and applications of silicon crystals in 1D

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This article reviews the growth concept of silicon nanowires with an attention to semiconductor nanowires filling the gap in the knowledge from the very original work to the very recent innovative experimental work. The objectives of this article are as follows; 1- to describe the original work of epitaxial growth of semiconductor nanowires, 2-to discuss the recently emerged technique of nanoscale templating controlling the growth position of nanowires and 3- to explore the possible technological applications of position-controlled silicon nanowires. Detailed description of the first reported successful vapor-liquidsolid (VLS) 1-D growth of silicon crystals is presented. Bottom-up approach and the supersaturation in a three-phase system then the nucleation at the chemical vapor deposition (CVD) processes are discussed with more focus on silicon. Positional assembly of nanowires using current available techniques including nanoscale chemical templating (NCT), can be considered as the key part of this document for advanced applications. Several applied and conceptional methods of developing available technologies using nanowires are included, such as, atomic force microscopy (AFM), photovoltaic (PV) cells and metal oxide semiconductor field effect transistors (MOSFET) are explained. The finial section of this review is devoted to the future trend in silicon nanowires research, where it is anticipated that the effort will proceed further to be implemented in daily electronic tools satisfying the demand of low wights and sizes electronics.

Recent Publications

1. Brent A Wacaser, Mark C Reuter, Maha M Khayyat, Cheng-Yen Wen, Richard Haight, Supratik Guha, Frances M Ross, et al. Growth Systems, Structure and Doping of Aluminum Seeded Epitaxial Silicon Nanowires. Nano Lett. 2009; 9(9): 269-301

2. Maha M Khayyat, Brent A Wacaser, Mark C Reuter, Frances M Ross, Devendra K Sadana, Tze-Chiang Chen. Nanoscale chemical templating of Si-NWs seeded with Al. Nanotechnology. 2013; 24(23): 235301

3. Maha M Khayyat. Silica Microspheres for Economical Advanced Solar Applications. Crystals. 2021; 11(11): 1409.

Speaker Biography

Maha Mohammad Khayyat is a research professor of physics of semiconductors at King Abdulaziz City for science and Technology, Materials Science Research Institute, Nanotechnology and Semicondctors Center (2015-present). She first started her professional carrier as a staff member of, physics department, Umm Al Qura University (1996-2015), KSA, delivering lectures, supervising MPhil candidates, she also contributed to the development of the university, she also improved her administrative skills via various management positions such as: vice dean of academia, vice dean of scientific research, advisor of the vice rector of Innovation, in addition to her membership at several committees.

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