Field-effect-enhanced single-nanowire energy storage devices

A vertically integrated multiple channel-based field-effect transistor (FET) with the highest number of nanowires reported ever is demonstrated on a bulk silicon substrate without use of wet etching.

The work presented in this thesis describes the bottom-up synthesis of Si and Ge nanowires for use as both anode materials for Li-ion batteries, and as channels in field effect transistors. The results are arranged as research articles with introductory summaries at the beginning of each chapter. For use as an anode material, Si boasts a superior capacity compared to graphite, ...

In this work, a normally-on single monocrystal ?-Ga2O3 nanowire (NW) back-gate field-effect transistor (FET) has been demonstrated by transferring MOCVD-grown ?-Ga2O3 NWs on sapphire onto SiO2 ...

Here, the operation of a field-effect transistor based on a single InAs nanowire gated by an ionic liquid is reported. Liquid gating yields very efficient carrier modulation with a ...

Single nanowire electrode devices are considered as a versatile platform for in situ probing the direct relationship between electrical transport, structure change, and other properties of the ...

Recently, silicon nanowire-based field-effect devices were prepared for the detection of single-stranded DNA molecules . The detection principle is based on the change in conductance induced by DNA charged molecules interact with probe molecules immobilized on the surface of the nanowire.

Such nanostructures can find applications in optoelectronic and electronic devices like nanowire lasers 9, field effect transistors 10,11,12,13, solar cells 14, photodetectors 15, photocatalysts ...

Three examples are presented: (a) Solar cell, photovoltaic device and single nanowire photovoltaic device; (b) Fuel cell, three-electrode system and individual nanosheet electrocatalytic device; (c) Cylindrical Li-ion battery, coin cell Li-ion battery and single nanowire energy storage device. The dominate components are labeled.

Semiconducting carbon nanotubes are robust molecules with nanometer-scale diameters that can be used in field-effect transistors, from larger thin-film implementation to devices that work in conjunction with silicon electronics, and can potentially be used as a platform for high-performance digital electronics as well as radio-frequency and sensing applications.

Semiconductor nanowires have attracted extensive interest as one of the best-defined classes of nanoscale building blocks for the bottom-up assembly of functional electronic and optoelectronic devices over the past

two decades. The article provides a comprehensive review of the continuing efforts in exploring semiconductor nanowires for the assembly of ...

Cupric Oxide (CuO) is one of the important materials for lithium-ion batteries [2], magnetic storage devices [3], solar cells [4], sensors [5], photovoltaic devices [6], high T c superconductors ...

The ascending trend of Moore"s law has stretched to the horizon, where the prospects of carbon-based materials show the potential of replacing the silicon-based complementary metal-oxide semiconductor technology. These alternatives include nanowire transistors, carbon nanotube field-effect transistors, quantum-dot cellular automata, and ...

It describes the efficiency of bending the energy bands and depends on the gate geometry, gate dielectric, nanowire thickness and doping concentration. Depending on the density of states nanowire field effect devices can be designed to operate either in a classical gate capacitance limited mode or the quantum capacitance limit.

In this work, an artificial electronic synaptic device based on gate-all-around InAs nanowire field-effect transistor is proposed and analyzed. The deposited oxide layer (In2O3) on the InAs nanowire surface serves as a charge trapping layer for information storage. The gate voltage pulse serves as stimuli of the presynaptic membrane, and the drain current and ...

The unique features of nanowire electrode materials exhibit many advantages: enhanced diffusion dynamics of carriers, enhanced structural stability of materials, befitting the in situ characterization of electrochemical process, and enhanced construction of flexible devices.

The growth details are described in the Methods section. Specifically, the SiNWs are assembled in a folded manner to form multi-channels by a single nanowire. This is achieved by leveraging the natural tendency of the SiNW to copy the shape of the guiding edge, as ...

The introduction of Sm can improve the traps in surface space charge region of SnO 2 nanowires, resulting in a controllable storage charge effect. For the single nanowire-based two-terminal device ...

One such innovation is the integration of nanowires into tunnel field-effect transistors (TFETs) which leverage quantum tunneling for highly energy-efficient charge transport. TFETs offer ultralow power consumption and subthreshold swing fundamentally reshaping the landscape of electronics for enhanced energy efficiency (Radamson et al. 2020 ...

Our work demonstrates the novel application of the field effect in energy-storage devices as a universal strategy to improve ion diffusion, which can greatly enhance the charge storage ability of ...

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Abstract Supercapacitors are favorable energy storage devices in the field of emerging energy technologies with high power density, excellent cycle stability and environmental benignity. The performance of supercapacitors is definitively influenced by the electrode materials. Nickel sulfides have attracted extensive interest in recent years due to their specific merits for ...

Heterostructured Bi2S3-Bi2O3 Nanosheets with a Built-In Electric Field for Improved Sodium Storage. ACS Applied Materials & Interfaces 2018, 10 (8) ... Perforated Metal Oxide-Carbon Nanotube Composite Microspheres with Enhanced Lithium-Ion Storage Properties. ACS Nano 2015, 9 (10 ... and Sustainability in Energy Storage Devices: A Review. ...

This paper reports the design of ferroelectric nanowires using HfO2 and Al2O3. Ferroelectric nanowire transistors have drawn considerable attention recently because of their potential for use in low-power devices and non-volatile memory systems. In this work, the drain current, acceptor concentrations, and electric field are analyzed. The results obtained for the ...

State-of-the-art 1D-SN energy nano-systems have been demonstrated to yield diverse outcomes of high significance including single-nanowire and array-based photovoltaic cells (InP nanowires with a maximum power conversion efficiency up to 17.8%), nanogenerators (SiGe nanowires with a maximum power output of 7.1 uW/cm 2), supercapacitors (core ...

In this work, a systematic study of titanium oxide (TiO2) nanowires incorporated polymer nanocomposite (PNC) films prepared by a standard solution cast technique is reported. The structural, morphological, dielectric, and electrochemical properties were investigated thoroughly. The polymer nanocomposite films demonstrated improved electrical and ...

In order to reveal the intrinsic mechanisms associated with the capacity decay of nanowire energy storage devices, Mai et al. designed and assembled an all-solid-state single nanowire on-chip electrochemical device for the in-situ detection of charge and discharge processes (Fig. 9 a). [50] For a single nanowire, two micro metal electrodes are ...

Our work demonstrates the novel application of the field effect in energy-storage devices as a universal strategy to improve ion diffusion, which can greatly enhance the charge storage ability of nanoscale devices.

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