

Characterization and Synthesis of Some One-dimensional Heterojunctions

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In the recent few years, some one-dimensional (1D) heterostructures, such as Si-CNT (carbon nanotube)^[1], Si-SiGe^[2], InAs-InP^[3], GaAs-GaP^[4] and so on, have been paid much attention to because heterostructures are widely used in many miniature devices.

By using a doable combination of electrochemical deposition and chemical vapor deposition, we have synthesized successfully some 1D heterojunctions, such as Ni-CNT^[5], Ag-Si^[5] and Pt₆Si₅-Si^[6], shown in Fig.1. Their diameters are controlled by the sizes of the pores of the templates used in the preparations.

By using a planar silicon p-n junction as the precursor in a self-assembling nanoelectrochemical technique^[7], large-area silicon nanowire (SiNW) p-n diode arrays have been successfully prepared, shown in Fig.2a. The method is rather simple. After a treatment of the planar p-n junction in an aqueous HF solution containing silver nitrate, the SiNW p-n diode arrays can be obtained on silicon substrates at near room temperature. Fig. 2b shows a typical I-V curve for a bundle of SiNW p-n diodes. The I-V curve reveals the rectifying behavior similar to that of planar silicon p-n junctions. These 1D heterojunctions are believed significant for the development of nano-devices.

References

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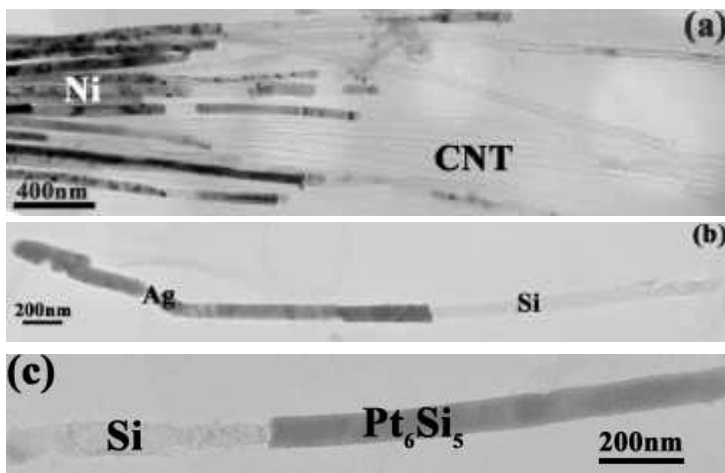


Fig. 1 Transmission electron microscope (TEM) images of (a) Ni-CNT, (b) Ag-Si and (c) Pt_6Si_5 -Si 1D heterojunctions.

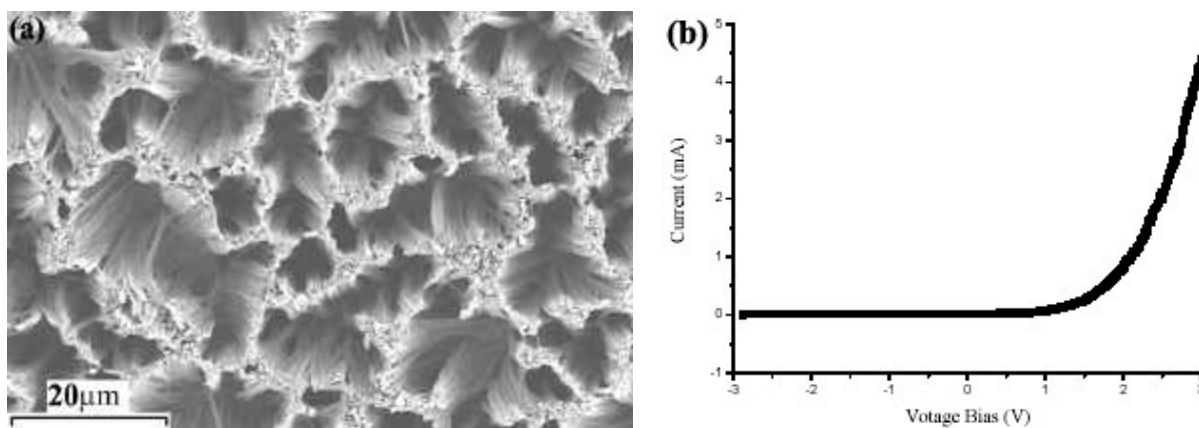


Fig. 2 (a) A scanning electron microscope (SEM) image of SiNW p-n diode arrays. (B) An I-V curve of a bundle of SiNW p-n diodes.