

Silicon nanowires as a pH sensor

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Silicon nanowires (SiNWs) have been used as the sensing layer in an extended gate field effect transistor (EGFET) for the measurement of pH solutions. The SiNWs were synthesized directly from the silicon substrates via a catalytic reaction under N₂ atmosphere at 955°C without supplying any gaseous or liquid Si sources. Nickel catalyst was deposited on the silicon substrates by sputtering. The average diameter of the SiNWs was about 30 ~ 50 nm and a length of up to a few tens of micrometers. In this research, the silicon bulk materials and SiNWs were used respectively as the sensing layer in an extended gate field effect transistor to measure the sensitivity of the pH solutions. Experimental results showed that the pH sensitivity of silicon bulk materials is poor. However, a good pH sensing properties of SiNWs, with sensitivities in the range of 58.3mV/pH, was observed. Therefore, it was suggested that the pH sensitivity of silicon bulk materials was greatly improved by downsizing into nanoscale.

Keyword: Silicon nanowires (SiNWs), Silicon bulk materials, pH sensitivity

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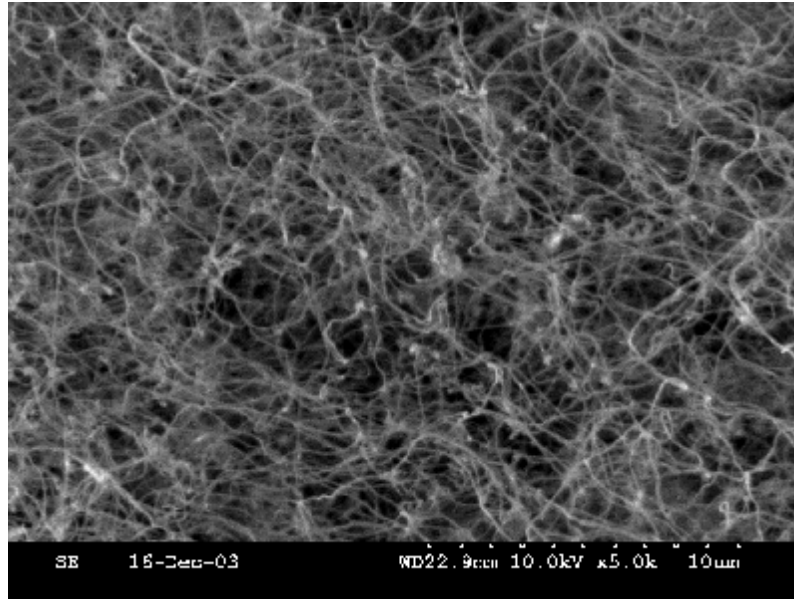


Fig. 1. SEM image of the silicon nanowires.

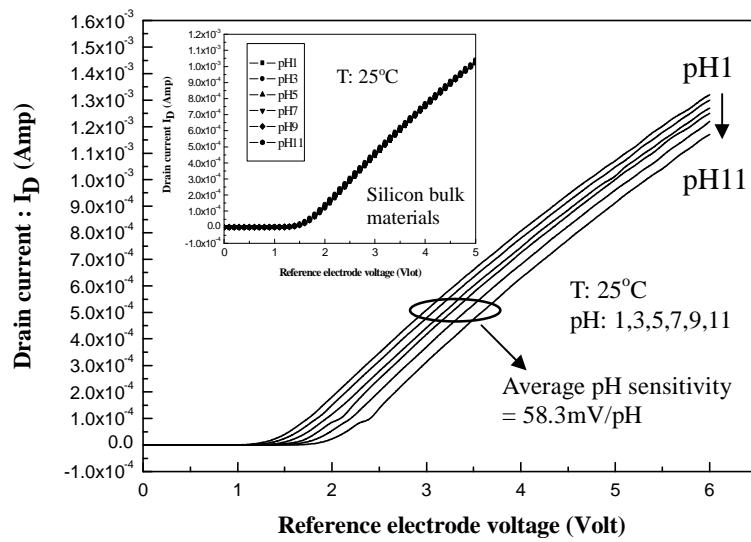


Fig. 2. I_D - V_{Ref} characteristics of EGFET with silicon nanowires (Inset: silicon bulk materials).