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pH Response of Silicon Nanowire Sensors: Impact of Nanowire Width and Gate Oxide

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We present a systematic study of the performance of silicon nanowires (SiNWs) with different widths when they are used as ion-sensitive field-effect transistors (ISFETs) in pH-sensing experiments. The SiNW widths ranged from 100 nm to 1 μm. The SiNW-ISFETs were successfully fabricated from silicon-on-insulator (SOI) wafers with Al_2O_3 or HfO_2 as gate dielectric. All the SiNWs showed a pH Response close to the Nernstian limit of 59.5 mV/pH at 300 K, independent of their width, or the investigated gate dielectric or operating mode. Even nanowires (NWs) in the 100 nm range operated reliably without degradation of their functionality. This result is of importance for a broad research field using SiNW sensors as a candidate for future applications.

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