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Effect of liquid gate bias rising time in pH sensors based on Si nanowire ion sensitive field effect transistors

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Highlights

- Experimental investigation in pH sensors based on Si nanowire ion-sensitive field-effect transistors (ISFETs)
- The effect of the rising time (T_R) of the liquid gate bias on transient response
- T_R and pH-dependent ISFET current
- Importance of retardation of mobile ions in analytes in terms of design of biosensors in which the ISFETs display a transient response

Abstract

In this study, we investigate the effect of rising time (T_R) of liquid gate bias (V_{LG}) on transient responses in pH sensors based on Si nanowire ion-sensitive field-effect transistors (ISFETs). As T_R becomes shorter and pH values decrease, the ISFET current takes a longer time to saturate to the pH-dependent steady-state value. By correlating V_{LG} with the internal gate-to-source voltage of the ISFET, we found that this effect occurs when the drift/diffusion of mobile ions in analytes in response to V_{LG} is delayed. This gives us useful insight on the design of ISFET-based point-of-care circuits and systems, particularly with respect to determining an appropriate rising time for the liquid gate bias.

Keywords: liquid gate bias, rising time, transient response, ISFET, Si nanowire, drift/diffusion of mobile ions in analyte.

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