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Jungkyu Jang[a], Jungmok Kim[a], Sungju Choi[a], Tae Jung Park[b], Byung-Gook Park[c], Dong Myong Kim[a], Sung-Jin Choi[a], Seung Min Lee[a], Dae Hwan Kim[a,*], Hyun-Sun Mo[a**],

[a]School of Electrical Engineering, Kookmin University, Seoul 02707, Republic of Korea

[b]Department of Chemistry, Chung-Ang University, Seoul 06974, Republic of Korea

[c]Department of Electrical and Computer Engineering, Seoul National University, Seoul 151-742, Republic of Korea

[*]Corresponding author. E-mail address: drlife@kookmin.ac.kr (D. H. Kim).

[**]Corresponding author. E-mail address: tyche@kookmin.ac.kr (H.-S. Mo).

J. Jang and J. Kim contributed equally to this work.

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 ISFESTs 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.