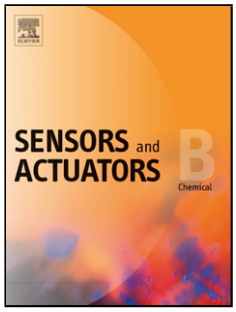

Title: A Dual-Indicator Strategy for Controlling the Response of Ionophore-Based Optical Nanosensors

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PII: S0925-4005(17)31863-4
DOI: https://doi.org/10.1016/j.snb.2017.09.203
Reference: SNB 23294

To appear in: *Sensors and Actuators B*

Received date: 11-5-2017
Revised date: 1-9-2017
Accepted date: 27-9-2017

Please cite this article as: Mark S.Ferris, Aakash G.Katageri, Greta M.Gohring, Kevin J.Cash, A Dual-Indicator Strategy for Controlling the Response of Ionophore-Based Optical Nanosensors, Sensors and Actuators B: Chemical https://doi.org/10.1016/j.snb.2017.09.203

A Dual-Indicator Strategy for Controlling the Response of Ionophore-Based Optical Nanosensors

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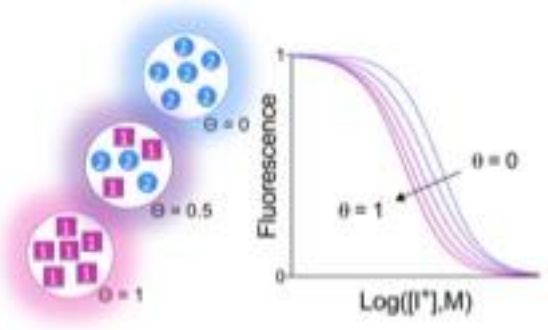
Graphical Abstract



Highlights

- We propose dual pH indicators for ionophore-based optical cation nanosensors.
- Adjusting the ratio of the two indicators controls the sensor $LogEC_{50}$.
- Dual-indicator use extends dynamic range span up to 47%.
- Dual-indicator coupled equilibria affects deprotonation and sensor response.

ABSTRACT

Optical nanosensors are used to detect a wide range of ions and molecules by changing their fluorescent properties in response to the local analyte concentration. Practical methods to adjust the sensor response characteristics of optical nanosensors are needed to match the sensor dynamic range with the expected analyte fluctuation for a given application. For ionophore-based optical sensors, the linear range is determined by three simultaneous equilibria, including the acid dissociation of a pH indicator. In this work, we add a second pH indicator to typical ionophore-based optical sensor formulations. We show that pH indicator acid-dissociation is fundamentally different when two indicators are loaded within the same nanoparticle, effectively coupling their equilibria, as opposed to being housed in separate sensor nanoparticles that simultaneously interact with the sample. We demonstrate that these two methods of dual-indicator sensor design give control over the response range of ionophore-based optical sensors and can extend the linear range span over what is possible with a single-indicator nanosensor.

ABBREVIATIONS

Author Biographies