Direct Covalent Attachment of Ion-Selective PVC Membrane Onto the Substrate for Improved Characteristics

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Solid-contact ion-selective electrodes (SC-ISEs) have demonstrated considerable potential in various fields such as environmental monitoring, bioanalytical measurements, and wearable sensors over the past decades. In recent works, conducting polymers including POT, PEDOT, and PPy have been widely used as ion-to-electron transducers for SC-ISEs, which significantly improve their ion response stability by preventing water layer formation. However, the reproducibility of standard potential (E0) is still one of the most significant and common problems to be solved [1]. Otherwise, it is necessary to calibrate each electrode before use, which is not desired.

To improve the E0 reproducibility for SC-ISEs utilizing conducting polymer as transducers, various strategies have been employed, such as the prepolarization of the conducting polymer layer or outer coating methods. [2, 3] For instance, the Lindfors group achieved significant enhancement in E0 reproducibility by prepolarizing the conducting polymer before the deposition of the polymer membrane cocktail [2]. Joon et al. improved the stability of the E0 by simply adding an outer layer of silicone rubber, which also exhibited potential in reducing biofouling [3].

We present here a novel strategy by creating a direct covalent linkage between the ion-to-electron transducer layer and the ion-selective membrane layer using click reaction. Specifically, CuAAC-based click chemistry was employed to covalently attach a thin layer of PVC onto the transducer layer that is either directly functionalized with ion sensing components or followed by the deposition of a second PVC layer with ionophores, ion exchangers, and plasticizer either through spin coating and drop-casting.

[1] S. Yuzhou, Y. Yibo, and P. Jianfeng, *Chem Soc Rev*, **2020**. *49*(13), 4405-4465.
[2] He, N., et al., *Anal Chem,* **2017**. *89*(4), 2598-2605.
[3] Joon, N.K., et al., *Anal Chem,* **2019**. *91*(16), 10524-10531.