Pyrolyzed MOF-based Solid Contacts for Stable and Reproducible Potentiometric Sensors

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Potentiometric sensors are widely used for ion activity monitoring due to their simple design and high selectivity. Their performance critically depends on the solid-state transducer layer, which governs potential stability and reproducibility.

Metal–organic frameworks (MOFs) are promising candidates for solid-contact layers because of their tunable porosity, high surface area, and adjustable chemistry. Here, we report the mechanochemical synthesis of cobalt imidazolate frameworks (ZIF-67) and ZIF-67 with encapsulated fullerene C_{60} as an efficient, green alternative for preparing MOF-based solid contacts.

We systematically investigated how in-pore fullerene encapsulation and subsequent pyrolysis affect ZIF-67's structure (PXRD, FTIR), capacitance (electrochemical impedance spectroscopy), and hydrophobicity (water contact angle). Pyrolysis of the fullerene encapsulated ZIF-67 at 750 °C, in nitrogen atmosphere resulted in a superhydrophobic material, with a water contact angle higher than 160°. Our results show that optimized MOF-based solid contacts significantly enhance electrode response reproducibility and long-term stability by minimizing potential drift compared to bare commercial screen-printed electrodes.

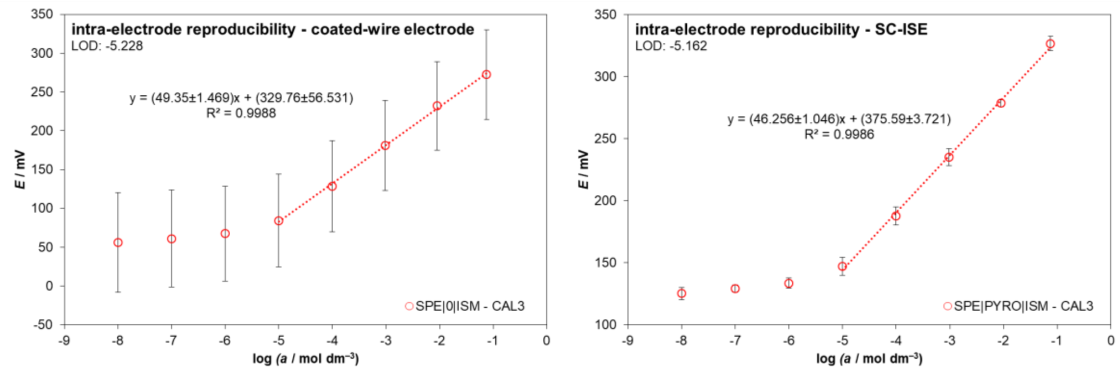

Figure 1: Potentiometric response reproducibility of screen-printed electrodes before and after including the pyrolised solid-state transducer layer.

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