Int. J. Electrochem. Sci., 15 **(2020)** 7423 – 7433

International Journal of ELECTROCHEMICAL SCIENCE
www.electrochemsci.org

In situ fabrication of Cu-bipy-BTC Metal-organic Framework Electrode for Catechol Detection

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doi: 10.20964/2020.08.52

Received: 13 May 2020 / *Accepted:* 27 May 2020 / *Published:* 10 July 2020

In this work, the metal organic frameworks (MOFs) Cu-bipy-BTC ($[Cu_2(OH)(2,2'\text{-bipy})_2(BTC)_3 2H_2O]_n$) were *in situ* synthesized on the surface of a gold electrode directly to form a hybrid material of a $Cu(OH)_2$ nanosheet and Cu-bipy-BTC nanoparticle. The structure of this hybrid material on the electrode surface was characterized using Fourier-transform infrared spectroscopy, X-ray diffraction, scanning electron microscopy, and energy-dispersive spectrocopy. It is shown that the newly *in situ* synthesized Cu-bipy-BTC MOF can serve as active metal centers, and is embedded in different hydrophobic environments formed by $Cu(OH)_2$ nanosheets. This unique structure is very similar to that of an active site of laccase, giving better catalytic activity. This MOF-based electrode enables the catalytic oxidation of catechol at +0.4 V (versus Ag/AgCl). The amperometric responses are linear with concentrations of catechol ranging from 10 to 250 μM and 250 to 1000 μM with sensitivities of 1.6224 and 0.2591 $\mu A \cdot cm^{-2} \cdot \mu M^{-1}$, respectively. Compared with other catechol electrochemical sensors, this MOF-based electrode has advantages of higher sensitivity and easy manufacturability, facilitating its potential application in the detection of catechol.

Keywords: hybrid structure, asymmetry Cu-bipy-BTC MOF, $Cu(OH)_2$ nanosheet, *in situ* fabrication, electro-catalysis, catechol detection

FULL TEXT