

A MXene-functionalized paper-based electrochemical immunosensor for label-free detection of cardiac troponin I

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Abstract: Convenient, rapid, and accurate detection of cardiac troponin I (cTnI) is crucial in early diagnosis of acute myocardial infarction (AMI). A paper-based electrochemical immunosensor is a promising choice in this field, because of the flexibility, porosity, and cost-efficacy of the paper. However, paper is poor in electronic conductivity and surface functionality. Herein, we report a paper-based electrochemical immunosensor for the label-free detection of cTnI with the working electrode modified by MXene (Ti_3C_2) nanosheets. In order to immobilize the bio-receptor (anti-cTnI) on the MXene-modified working electrode, the MXene nanosheets were functionalized by aminosilane, and the functionalized MXene was immobilized onto the surface of the work electrode through Nafion. The large surface area of the MXene nanosheets facilitates the immobilization of antibodies, and the excellent conductivity facilitates the electron transfer between the electrochemical species and the underlying electrode surface. As a result, the paper-based immunosensor could detect cTnI within a wide range of 5–100 ng/mL with a detection limit of 0.58 ng/mL. The immunosensor also shows outstanding selectivity and good repeatability. Our MXene-modified paper-based electrochemical immunosensor enables fast and sensitive detection of cTnI, which may be used in real-time and cost-efficient monitoring of AMI diseases in clinics.

Key words: paper-based immunosensor; MXene; electrochemical detection; cardiac troponin I (cTnI)

Citation: L Wang, Y F Han, H C Wang, Y J Han, J H Liu, G Lu, and H D Yu, A MXene-functionalized paper-based electrochemical immunosensor for label-free detection of cardiac troponin I [J]. *J. Semicond.*, 2021, 42(9), 092601. <http://doi.org/10.1088/1674-4926/42/9/092601>

Support Information

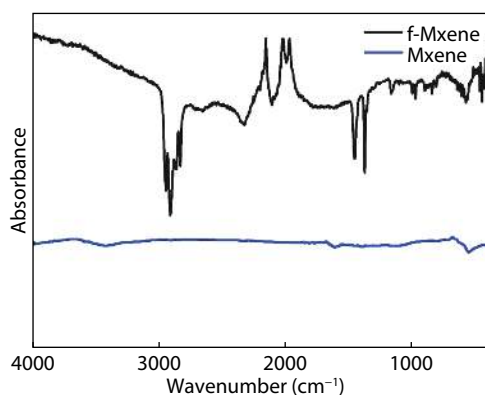


Fig. S1. Fourier transform infrared (FT-IR) spectra of pristine MXene and f-MXene.

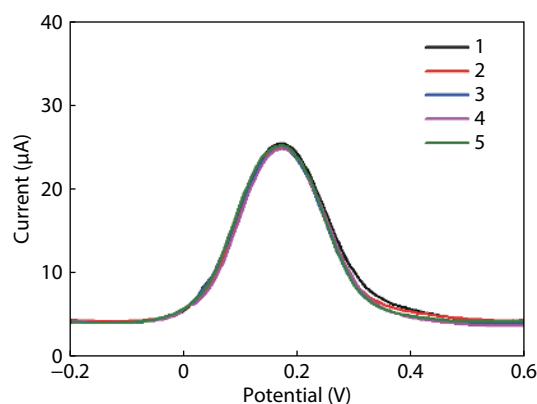


Fig. S2. Reproducibility of the proposed immunosensor incubated cTnI in the same batch.

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Received 8 FEBRUARY 2021; Revised 19 APRIL 2021.

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