

Growth of hybrid nanoflowers on activated carbon fibers as electrodes for mediatorless enzymatic biofuel cells

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Enzymatic biofuel cells could efficiently generate electricity from bioresources; however, they have several limitations including the instability and low power output. Herein, we developed a potent strategy to grow hybrid nanoflowers (HnFs) consisting of enzymes (laccase, glucose oxidase, or catalase) and copper phosphate crystals through in situ growth on activated carbon fibers (ACFs). The resulting HnFs/ACF yielded up to 4-fold higher enzymatic activities with 2-fold longer stability than those of immobilized enzymes physically adsorbed on ACFs. The power density of HnF/ACF-based glucose biofuel cell was determined to be $50 \mu\text{W cm}^{-2}$ with 50 mM glucose, which is 3–5 times higher than that of conventional biofuel cells, and the power-generating performance of HnF/ACF-based biofuel cell was efficiently maintained over one month of operation.