

Modification of PPy-NW anode by carbon dots for high-performance mini-microbial fuel cells

ABSTRACT

To boost the performance of microbial fuel cells (MFCs), a novel material of polypyrrole nanowires (PPy-NWs) modified by carbon dots (CDs) is synthesized by polymerizing pyrrole monomers and CDs, in which CDs are attached and distributed on the surface of the PPy-NWs, thus leading to the rough surface with a special dot-line structure. Such CDs/PPy-NW composite with special unique structure exhibits superior properties, and excellent performance is found for MFC using CDs/PPy-NW composite as anode. The electron transfer rate increases to 0.0934 s^{-1} with a sharp rise by 26% over pure PPy-NWs, and the resistances of CDs/PPy-NW electrode are only one third of those of pure PPy-NWs electrode. Further, the mini-MFC equipped with the CDs/PPy-NW composite as anode exhibits a high open circuit voltage (630 mV) and its maximum power density with a value of 291.4 mW m^{-2} is twice that of the mini-MFC equipped with pure PPy-NWs anode. These results demonstrate CDs/PPy-NW with a unique dot-line structure as a more promising anode material for MFC application.