Abstract

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Unveiling microbiologically influenced corrosion engineering to transfigure damages into benefits: A textile sensor for H2O2 detection in clinical

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Abstract

With the ongoing increasing research interests in economical electrocatalysts, transforming damages into benefits to prepare useful electrode materials is an ideal strategy to achieve the goals. Corrosion engineering converts harmful corrosion processes into high performance catalyst nanostructures. In this work, we develop an inexpensive, scaled-up corrosion engineering strategy for value-added transformation of low-cost iron substrates into highly efficient Cu-Fe(OH)2-FeS deposited on polyester cloth fabric (PCF) flexible electrode by a process of electroless plating combined with microbes assisted corrosion product. The anaerobic sulfate reducing bacteria (SRB) converting sulfate to sulfide play vital role to carry out the construction of Cu-Fe(OH)2-FeS/PCF electrode which reveals high electrochemical sensing performance for H2O2 with broad linear range and low detection limit of 0.2 nM (S/N=3). The enhanced activity arises from densely deposited nanosheets of transition metals oxides/hydroxides, plethora of surface active sites and synergistic effect between Cu-Fe(OH)2 and FeS species. More importantly, the S2− ions serving as co-catalyst have been found to continuously fuel electrons during the reduction of Fe(III) and Cu(II) which accelerate the redox cycles of Fe(III)/Fe(II) and Cu(II)/Cu(I) further enhancing electrocatalytic H2O2 reduction. With high sensitivity achieved, the Cu-Fe(OH)2-FeS/PCF electrode has also been practically applied in real-time in vitro tracking of H2O2 excreted from different normal and human brain cancer cell lines as well as in situ sensitive detection of H2O2 released from human brain tumor tissues. This work presents a good way to bridge up the gap between annoying traditional corrosion engineering and emerging electrochemical technologies.

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Biography

Dr. Muhammad Asif has completed his PhD at the age of 31 years from Huazhong University of Science and Technology (HUST), China and postdoctoral studies from School of Chemistry and Chemical Engineering, HUST. Currently, he is postdoc fellow in School of Materials Science and Engineering, Wuhan Institute of Technology, China. He has published more than 58 papers with commulative Impact Factor of 381, in reputed journals like BB, AC, CEJ, ACS-AMI, SNB, advances in colloid and interface science and has been serving as an editorial board member of Frontiers in Chemsitry, Frontiers in Analytical Science.

