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Nanoplatform based on vertical nanographenes grown by plasma enhanced chemical vapor deposition for sensor devices

Hydrogen peroxide (H_2O_2) is one of relatively long-lived reactive oxygen species. The catalytic reactions of H_2O_2 with ferrous ions form hydroxyl radicals in living organism and the radical causes oxidative stress to proteins and DNA. On the other hand, the intracellular signaling involving the redox reactions of H_2O_2 has a vital role for physiology such as metabolic changes and immune reactions in the organism. Therefore, the monitoring of H_2O_2 in human body has attracted in the medical fields. Electrochemical measurement enables us to estimate the H_2O_2 concentrations to analyze the redox reactions on the electrode. In the measurement, the detection sensitivity depends on the surface area of electrode. Carbon nanowalls (CNWs) composed of few-layer graphenes standing vertically on the substrate have a 3-dimensional structure with extremely large surface area. In this study, the CNWs were used as a platform for H_2O_2 sensing. The carbon fiber paper (CFP) was used as a substrate for the CNWs growth. The CNWs was grown by inductively coupled plasma plasma-enhanced chemical vapor deposition using CH_4/Ar gas mixture. And then, the Pt nanoparticles as a catalyst were supported by the reduction of H_2PtCl_6 on the surface of CNWs. From results of cyclic voltammetry with the Pt-supported CNWs/CFP electrode, the excellent electrocatalytic activity to the reduction of H_2O_2 was observed. Moreover, amperometric response was exhibited in a wide linear range of 10–1500 μM of H_2O_2 concentration. The electrochemical experiments indicate that nanoplatforms with the CNWs have a potential for realizing high performance of electrochemical sensing.

Biography

Keigo Takeda has received his PhD from Nagoya University and Postdoctoral studies from graduate school of Engineering Nagoya University. He is an Associate Professor of Meijo University from 2017. He has published more than 90 papers in reputed journals. His current research interests include reaction mechanisms of reactive species in plasma processes for advanced materials synthesis, fine processing technology, biomedical applications, etc.

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