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### 3D graphene network as catalyst support material for electrochemical applications

Graphene-based materials have attracted much attention due to their outstanding properties as well as emerging applications. Carbon nanowalls (CNWs) are few-layer graphenes standing vertically on a substrate forming a self-supported network of 3-dimensional wall structures. CNWs and similar vertical graphene structures are sometimes decorated with metal nanoparticles. The maze-like architecture of CNWs with large-surface-area graphene planes would be useful as electrodes for energy devices and electrochemical sensors. CNWs can be synthesized by plasma enhanced chemical vapor deposition (PECVD) techniques on heated substrates (600-750 °C) employing methane and hydrogen mixtures. The height of CNWs increases almost linearly with the growth period, while the thickness of walls and interspaces between adjacent walls are almost constant. We have carried out CNW growth using PECVD, and the surface of CNWs was decorated with Pt nanoparticles by the reduction of chloroplatinic acid or by the metal-organic chemical deposition employing supercritical fluid. We report the performances of fuel

cell and hydrogen peroxide sensor, where CNW electrode was used. From the electrochemical evaluation, it was confirmed that Pt-supported CNWs had seven times higher durability than the conventional carbon black. In the case of hydrogen peroxide sensing, amperometric response results indicated that the Pt-decorated CNWs exhibited a wide linear range of 10–1500 μM. Electrochemical experiments demonstrate that CNWs offer great promise for providing a new class of nanostructured electrodes for fuel cell and electrochemical applications.

#### Speaker Biography

Mineo Hiramatsu is a Full Professor of Department of Electrical and Electronic Engineering and the Director of Research Institute, Meijo University, Japan. His main fields of research are plasma diagnostics and plasma processing for the synthesis of thin films and nanostructured materials. He served as chairman and member of organizing and scientific committees of international conferences on plasma chemistry and plasma processing. He was awarded the Japan Society of Applied Physics Fellow in 2017.

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