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### Vertical graphene network as platform for electrochemical and bio applications

Graphene (monolayer and few layers) is a two-dimensional material with the large anisotropy between in-plane and out-of-plane directions. Carbon nanowalls (CNWs) are few-layer graphenes with open boundaries, standing vertically on a substrate to form a self-supported network of maze-like wall structures. This kind of carbon nanostructure is also called as carbon nanoflake, carbon nanosheet, graphene nanosheet, and graphene nanowall. CNWs and similar graphene structures can be synthesized by plasma enhanced chemical vapor deposition (PECVD) techniques on several heated substrates (600-800 °C) employing CH<sub>4</sub> and H<sub>2</sub> mixtures. CNWs are sometimes decorated with metal nanoparticles and biomolecules. The structure of conductive CNWs with large surface area would be suitable for the platform in electrochemical and biosensing applications. CNW films can be potentially used as electrodes of electrochemical sensor, capacitor, dye-sensitized solar cell, polymer electrolyte fuel cell (PEFC) and implantable glucose fuel cell (GFC). Control of CNW structures including spacing between adjacent nanowalls and crystallinity is important for the practical applications. Moreover, surface functionalization including surface termination and decoration with catalytic metal nanoparticles should be established. We report the current status of fabrication and structure control of CNWs. For the application, CNW surface was decorated with Pt nanoparticles by the reduction of chloroplatinic acid or by the metal-organic chemical deposition employing supercritical fluid. We also report the performances of hydrogen peroxide sensor, PEFC and GFC, where CNW electrode was used.

### Biography

Mineo Hiramatsu is a Full Professor of Department of Electrical and Electronic Engineering and the Director of Research Institute, Meijo University, Japan. He served as the Director of Japan Society of Applied Physics. His main fields of research are plasma diagnostics and plasma processing for the synthesis of thin films and nanostructured materials. He is author of more than 100 scientific papers and has patents on plasma processes for materials science. He is a member of organizing and scientific committees of international conferences on Plasma Chemistry and Plasma Processing and a Fellow of Japan Society of Applied Physics.

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