

# Materials Science and Materials Chemistry

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## Mineo Hiramatsu

Meijo University, Japan

Synthesis of vertical graphene network and its emerging 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 layered graphene 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 carbon nanoflake, carbon nanosheet, graphene nanosheet, and graphene nanowall. CNWs are sometimes decorated with metal nanoparticles and biomolecules. The structure of conductive CNWs with a large surface area, combined with surface decoration, would be suitable for the platform in electrochemical and biosensing applications. CNWs and similar vertical graphene structures can be synthesized by plasma enhanced chemical vapour deposition (PECVD) techniques on heated substrates (600-800°C) employing methane and hydrogen mixtures. Control of CNW structures including spacing between

adjacent nanowalls and crystallinity is significant 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. Moreover, the 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 and fuel cell, where CNW electrode was used.

### 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 is an author of more than 100 scientific papers and patents on plasma processes for materials science and a Japan Society of Applied Physics Fellow.

e: mnhmrt@meijo-u.ac.jp

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