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Synthesis and application of vertical graphene network

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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. The sheets form a self-supported network of mazelike-wall structures. CNWs and similar graphene structures can be synthesized by several plasma enhanced chemical vapor deposition (PECVD) techniques. CNWs are sometimes decorated with metal nanoparticles and biomolecules. The structure of 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 electrochmical sensor, capacitor, dye-sensitized solar cell, polymer electrolyte fuel cell (PEFC), and implantable glucose fuel cell (GFC). Among these, CNW electrodes in fuel cells should be decorated with catalytic nanoparticles such as Pt. From a practical point of view, control of CNW structures including spacing between adjacent nanowalls and crystallinity is significantly important. Moreover, formation method of catalytic metal nanoparticles should be established. We carried out CNW growth using PECVD employing $CH_4/H_2/Ar$ mixtures with emphasis on the structure control of CNWs. We report the effects of ion bombardment and catalytic metals on the nucleation of vertical nanographenes to realize active control of interspace between adjacent walls. Moreover, 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 The 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. Author of more than 100 scientific papers and patents on plasma processes for materials science. Member of organizing and scientific committees of international conferences on plasma chemistry and plasma processing. Japan Society of Applied Physics Fellow

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