課題番号 : F-12-AT-0079

※支援課題名(日本語) :

※Program Title(in English) : Characterization of n-type pyrolyzed parylene C via Raman spectral mapping

※利用者名(日本語) :

※Username(in English) : Kirstin Morton

※所属名(日本語) :

※Affliation(in English) : Indiana University, Department of Chemistry, Bloomington IN, USA

※概要(Summary):

Research was carried out characterize the structure of doped conductive carbon electrodes fabricated from pyrolyzed parylene C (PPC). These carbon electrodes were fabricated on planar substrates and can be chemically transferred to a variety of other substrates. At AIST, efforts were undertaken to chemically create n-type PPC through the use of previously established methods. Various electrical characterization techniques were employed outside the NPF to confirm the success of chemical doping on the PPC thin films. Raman spectral mapping was performed at the NPF to determine the effect on chemical treatments to the films. We found that chemical treatment of PPC with hydrazine resulted in an decrease in the overall disorder of the film, as compared to pristine PPC, as seen by an increase in ratio of D band intensity to G band intensity over a 250 X 250 μm² area.

※実験(Experimental):

Pyrolyzed parylene C thin films of approximately 1 cm² were prepared on n-doped silicon, with ~10 nm oxide layer. p-type PPC was created from pristine PPC by treatment of pristine PPC thin films with 1.0 M hydrazine (in THF) for approximately one hour in an inert atmosphere. Films were then rinsed in isopropyl alcohol and allowed to air dry overnight, prior to spectral mapping. Raman spectroscopy and spectral mapping of pristine and n-type PPC (250 μm² area with a step size of 10 μm) were performed with a ThermoScientific DXR Raman microscope (ThermoScientific, Waltham, MA) equipped with a 2mW 532 nm laser. Raman spectral mapping was undertaken with the assistance of Ms. Kazumi Hayama of the NPF at AIST (Tsukuba, Japan).

※結果と考察(Results and Discussion):

The intensity ratio of the D and G bands (I_D/I_G) can reveal in-plane and edge defects in carbon materials; thus, the I_D/I_G value was plotted as color gradations in the Raman spectral mapping experiments for 10 μm step sizes. False-color Raman spectral maps for pristine and n-type PPC samples are shown in **Figure 1** (please see separate report for analysis on p-type PPC). The color scale in **Figure 1** represents I_D/I_G from 0-1.3 and each sample has been normalized to the same scale. For $I_D/I_G > 1$, we can conclude the area contains defects and for $I_D/I_G < 1$, more graphitic or ordered carbon content is present. The pristine PPC sample appears to have large areas of defects and some areas where $I_D/I_G \sim 1$. However, for n-type PPC we see that I_D/I_G is less than 1 (~ 0.7 throughout) and more homogenous in terms of defects. Hydrazine may be preferentially physisorbed to edges of crystallites in the film and contribute more order to the overall film.

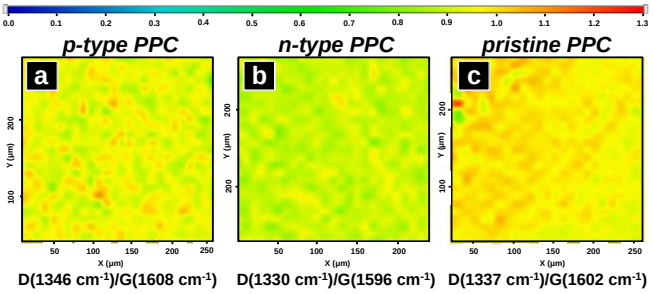

Figure 1. Raman spectral maps for p-type, n-type and pristine PPC samples.

※その他・特記事項(Others):

共同研究者等(Coauthor):

Kazumi Hayama (AIST), Hideo Tokuhisa (AIST), Lane A. Baker (Indiana University, Bloomington IN, USA).

論文・学会発表(Publication/Presentation):

1.) Morton, K.C.; Hayama, K.; Ootsuka, T.; Tokuhisa, H.; Baker, L.A. *"Chemical Doping of Pyrolyzed Parylene C Electrodes."* Turkey Run Analytical Conference, Marshall, IN, November 2nd-November 3rd, 2012.