Low temperature reduction of silylated graphite oxide thin films by UV light irradiation

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Introduction

Graphene based carbon thin films prepared from graphite oxide are promising for the transparent and conducting electrodes, etc. However, in order to obtain the films with a high conductivity, it is necessary to heat the samples at high temperatures, which limits the choice of substrates. In this study, graphene based carbon thin films were prepared from silylated graphite oxide thin films at lower temperatures than 100°C by UV light irradiation.

Experimental

Graphite oxide with the composition of C_8OH was obtained from synthetic graphite (Aldrich, 1-2μm). It was silylated with octyltrichlorosilane (abbreviated as C_8SiGO) and then n-hexadecylamine was intercalated. The product was dispersed in chloroform and then the resulting solution was cast on the quartz or glass substrates. The n-hexadecylamine molecules were removed by washing with ethanol. The obtained C_8SiGO films were reduced by irradiating UV light using an ultra high pressure UV lamp (USHIO-500D) for 0.5 - 24 h. For comparison, these films were pyrolyzed under vacuum for 5h.The sheet resistance of the samples was measured by a potential sweep method.

Results and discussion

Fig.1 shows the UV-vis spectra of C_8SiGO films after irradiating UV light for various times. The absorption peak at 300 nm disappeared after 0.5 h and the peak at 228 nm shifted to longer wavelength as the irradiation time became longer and reached 265 nm after 24 h. This suggests that the removal of the oxygen containing functional groups from GO layer and π conjugate system was recovered. 2 shows the variation of the sheet resistance after irradiation of UV light as a function of the transmittance at 400 nm, together with those of the samples obtained from the pyrolysis at 500°C. It was around 10kΩ/sq and was very similar to that observed for the film prepared by the pyrolysis at 500°C, though the temperature of the sample was less than 100°C.

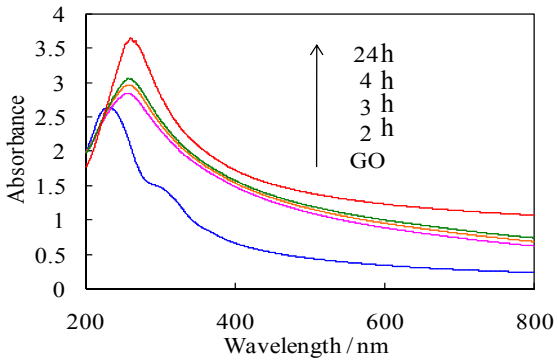

Fig.1 UV-Vis spectra of C_8SiGO film before and after UV irradiation.

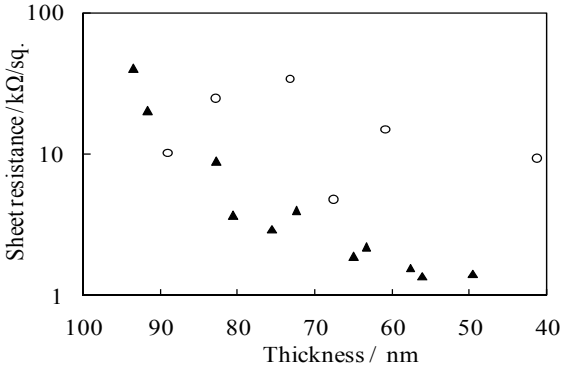

Fig.2 Sheet resistance of C_8SiGO film reduced by UV irradiation as a function of transmittance at 400 nm, together with that of thermally reduced C_8SiGO films