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신광원 카본의 전기적 특성

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Electrical Properties of Carbon film for Application of New Light Source

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Abstract - The carbon film was deposited by the electrolysis of methanol solution. From investigations of the Raman spectroscopy and the FTIR spectroscopy, the carbon film deposited by the electrolysis was identified the hydrogenated carbon film with the porous structure. The carbon film deposited by electrolysis of methanol was identified as the hydrogenated carbon film with porous structure.

1. 서 론

Carbon is known to be a typical high temperature semiconductor, very inert to chemical substances, and a number of attempts have been made to fabricate both passive and active electronic devices using diamond. It was recently recognized that the electronic properties of diamond are strongly influenced by surface modifications ; for instance, hydrogenation of carbon surface leads to a marked increase in conductivity, while subsequent treatments in oxygen ambient result in an increase in resistivity. Carbon films have recently attracted much interest for their potential use as hard, wear resistant films, and optical coatings. From the viewpoint of practical applicants, the deposition techniques by the electrolysis of organic solution have many advantages, such as simplicity of the apparatus, low deposition temperature and availability for large area deposition. The carbon films contain sp3 and sp2 carbon bonds, which is well-known. However, characteristics of carbon bonds in the films formed by electrolysis are not still investigated. Furthermore, there is no examination with respect to hydrogenation of these films. In this paper, form results of Raman spectroscopy and FTIR, it is pointed out that the amorphous carbon film deposited by the electrolysis of methanol solution was identified as the hydrogenated carbon film that containing sp3 and sp2 carbon bonds with porous structure.

2. 실험방법

The carbon film was deposited on silicon substrate by using the electrolysis of methanol solution. The ex perimental apparatus consisted of an electrolytic bath, two electrodes and DC power supply. Backside of the Si substrate was covered with prevents current leak. Just before the deposition of carbon film, native oxide on Si substrate was etched in diluted HF solution. A carbon plate and the negative electrodes, respectively. Distance between the two electrodes was set to 1mm. The constant DC potential of 2kV was applied during the deposition of the carbon film.

The current density was held at 15mA/cm^2 for initial period of the electrolysis of methanol solution. The current density increased up to 50mA/cm^2 with increase of the electrolysis time. Then, it decreased up to 10mA/cm^2 in final period of the electrolysis. Temperature of the methanol solution was at 26℃ when the deposition of the carbon film begins. The temperature of the methanol solution increased during the deposition of a carbon film. At the final period of electrolysis, temperature became at 65℃ which is the boiling point of methanol. The increase of current density during the deposition is caused by the increase of methanol solution temperature. The decrease of current density during electrolysis suggests that the high resistivity carbon film was deposited on the silicon substrate.

3. 결과 및 고찰

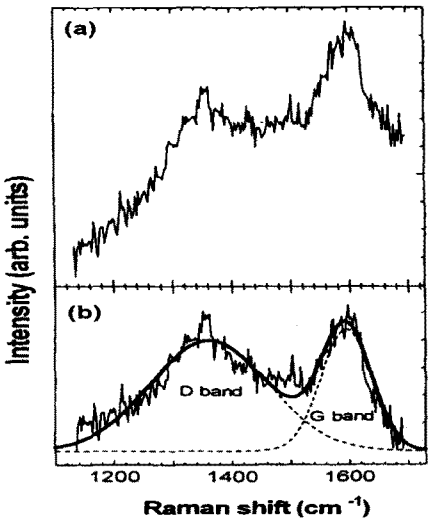

Fig. 1. Raman spectroscopy spectrum of the carbon film.

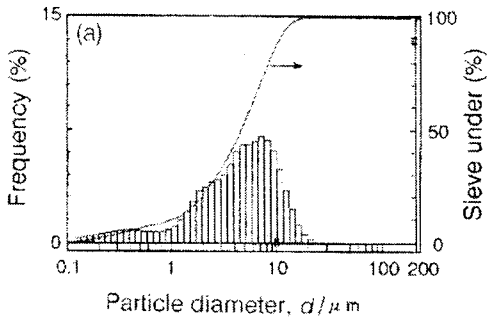

Fig. 2. The particle distribution of the precursor.

Figure shows the raman spectroscopy spectrum of the carbon film. Background underlines in the range of 1100 to 1730 cm^{-1} in Raman spectrum. Such broad background was identified a PL signal which can be observed when a incident laser beam is partially absorbed in the film. Intensity of the luminescence becomes larger with increase of the hydrogen content. It suggest that the hydrogen is involved in the carbon film. The carbon film was deposited by the electrolysis of methanol solution. From investigations of the Raman spectroscopy and the FTIR spectroscopy, the carbon film deposited by the electrolysis was identified the hydrogenated carbon film with the porous structure. Fig.1(b) shows the Raman spectrum of after correction for the background on the base line. Such the spectrum can be decomposed into two the broad bands of which peaks locate at 1590cm^{-1} and 1360cm^{-1}. Generally, these bands originate from carbon with an sp^2 configuration.

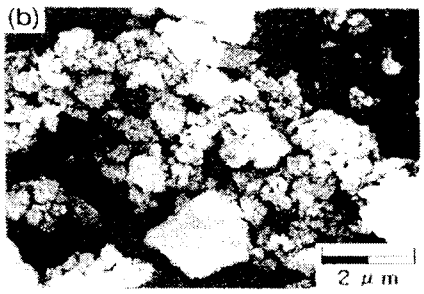

Fig. 3. SEM image of the precursor.

4. 결 론

The carbon film was deposited by the electrolysis of methanol solution. From investigations of the Raman spectroscopy and the FTIR spectroscopy, the carbon film deposited by the electrolysis was identified the hydrogenated carbon film with the porous structure.

감사의 글

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[참 고 문 헌]

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