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탄소 음이온 에너지가 DLC 박막 물성에 미치는 영향
The effects of negative carbon ion beam energy on the properties of DLC films

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1. 서론

Since Diamond-like carbon (DLC) films have a mechanical hardness, low friction coefficient, chemical inertness, and optical transparency, high quality thin DLC films have various applications including micro electro mechanical devices and protection layer of cutting tools, moldings, and magnetic storage medias [1,2,3]. It is well known that the sp3/sp2 atomic carbon ratio in DLC film is strongly related to the quality of DLC films and in general, the higher the sp3/sp2 ratio, the closer the DLC film properties approach those of diamond [4]. In this study, DLC films were prepared by DMIBD under different negative carbon ion beam energy conditions and then, the effectsof negative carbon ion beam energy on the bonding configurations and properties of DLC films were investigated.

2. 본론

The effects of negative carbon ion beam energy on the bonding configuration, surface morphology, and electrical resistivity of DLC film prepared by a direct metal ion beam deposition system were investigated. As the negative carbon ion beam energy increased from 25 to 150 eV, the sp3fraction of DLC films was increased from 32 to 67%, while the surface roughness was decreased. The film prepared at 150 eV showed the more flat surface morphology of the film than that of the film prepared under another ion beam energy conditions. Surface nano-hardness increased from 12 to 57 Gpa when increasing the negative carbon ion beam energy from 25 to 150 eV, and then decreased when increasing the ion beam energy from 150 to 200 eV. These properties of the films corresponded to the bonding configurations of DLC films.

3. 결과

In order to investigate the effects of negative carbon ion beam energy on thebonding configuration and surface morphology of DLC film, the films were prepared on a Si(100) substrate by a direct negative metal ion beam deposition system at different levels of ion beam energy. As the ion beam energy increased from 25 to 150 eV, plasmon loss peak in the XPS spectra decreased. This result meant that the sp3 bonded structure increased in DLC film with an increase of carbon ion energy ($\leq$ 150 eV). The sp3 fraction measured from the XPS spectra increased from 32 to 67%. But the DLC film prepared at 200 eV had a lower sp3 fraction than that of the film prepared at 150 eV. Hardness also increased from 12 to 57 Gpa with carbon ion beam energy ($\leq$150 eV) but the higher ion beam energy (>150 eV) may have lead to a lower hardness of the film due to graphitization with intense ion bombardments. These properties of DLC films corresponded to the bonding configurations of the DLC films.

참고문헌

1. I. Kleps, A. Angelescu, Solid State Electronic. 45 (2001) 997.
2. M. Schlatter, Diamond Relat. Mater. 11 (2002) 1781.
3. H. Hanyu, S. Kamiya, Surf. Coat. Technol. 200 (2005) 1137.
4. L. Xia, M. Sun, J. Liao, Diamond Relat. Mater. 14 (2005) 42.