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ABSTRACT BOOK

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Ti bipolar plate coated with a-C film at 600°C shows the maximum output power of 1.8W. Impedance analyzer measurement for these FCs indicated that the increase in the growth temperature decreased the contact resistance between the bipolar plate and MEA. Therefore, the FC fabricated with the metal bipolar plate, which is coated with a-C film at high temperature, shows high output power.

Keywords: a-C film, fuel Cell, bipolar plate, contact resistance

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[15.10.03]

Deposition of a-C:H film on an artificial heart blood pump using r.f. plasma CVD process with free shape 3-dimensional type electrode

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Amorphous hydrogenated carbon (a-C:H) films, which have many attractive characteristics including biocompatibility, are expected as new biomedical applications. However, it is difficult to fabricate uniform a-C:H films onto insulator material surfaces with a 3-dimensional shape as artificial heart blood pump using radio frequency (r.f.) plasma chemical vapor deposition (CVD) process. In this study, in order to fabricate uniform a-C:H film on an artificial heart blood pump, r.f. plasma CVD process with free shape 3-dimensional type electrode process has been developed. The free shape electrode consisted of a lot of small chromium particle (φ0.8 mm) and it was possible to adjust shape freely to an artificial heart blood pump.

Using the free shape electrode, we succeeded in deposition of uniform the a-C:H film on the artificial blood pump (CH_4 gas pressure: 50 Pa, Deposition time: 30 min, r.f. plasma power: 100 W). In estimating the uniformity of the a-C:H film, the film thickness was measured using scanning electron microscopy (SEM). The structures of the film were evaluated with infrared spectroscopy (IR), Raman spectroscopy (Raman), and X-ray photoelectron spectrometer (XPS). The a-C:H film was deposited uniformly at approximately 400 nm and also the structures were uniform. The free shape electrode process could uniformly hold a blood pump surface at self-bias voltage. As a result, this electrode could uniformly keep the ion sheath on the surface. Moreover, it was observed that the a-C:H film had good stability adhesion on the blood pump.

The free shape 3-dimensional type electrode process was observed to be quite applicable to complicated structures such as an artificial hart blood pump.

Keywords: a-C:H film, r.f. plasma CVD process, 3-dimensional structures, artificial heart blood pump

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[15.10.04]

Nanoscratch behavior of amorphous carbon films fabricated on W-implanted steel substrates

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Amorphous carbon (a:C) has been applied to various applications due to its favourable tribological and mechanical properties. However, poor adhesion between a:C and tool steels has limited its applications. It is well known that the introduction of an interlayer such as Si, Cr, Ti and Mo, etc. is an effective way to promote film adhesion. In addition, the use of a series of functionally graded underlayers or periodical repeating multilayers has been proposed to solve the problem. Recently, the synthesis of adherent a-C films on substrate pretreated by ion implantation has been reported. However, based on our knowledge, few elements except carbon have been chosen as the implanted species and detailed studies on the tribological performance are quite limited.

Considering the chemical affinity between W and C, a-C films can be deposited on 321 stainless steel substrate that has been pre-implanted with W. Compared to a W interlayer, the modified layer has structural connectivity with the substrate. The objective of this study is to investigate the elastic and tribological properties of films prepared on W-implanted substrate and compare to a:C films deposited on a W interlayer. The adhesion and deformation characteristics of the films were evaluated using nanoscratch tests. The film deformation response was studied to gain a better understanding of the mechanism governing failure of the thin films. The nanoscratch apparatus used in this work can make finely controlled and low load scratches. It can also provide measurements on the coefficient of friction as well as information about the in situ surface elastic-plastic deformation depth during the test.

Keywords: Amorphous carbon, nanoscatch, W ion implantation