

DLC Coating on Extra Fine Wire by Quadrupole Magnetron Plasmas and CVD&PVD Hybrid Method

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Abstract

It was investigated on the DLC hybrid (CVD&PVD) coating method on extra fine wire by using the quadrupole magnetron plasma with line-shaped AC discharges. It is reported the quality of deposited carbon thin films on the wire.

Introduction

The present study aimed to attempt the improvement of safety of the extra fine guidewire with several 100 μ m in diameter by DLC with strong abrasion quality, high hardness, high sliding and biocompatible properties such as antithrombogenicity and blood compatibility.

It has been investigated to develop the coating method to deposit the high quality (adhesion and uniformity) DLC films used by Quadrupole Magnetron Plasmas and CVD&PVD Hybrid method. In the present work, we performed to deposit DLC films to the surface of extra fine wire for various discharge voltage, gas mixture and deposition time.

Experimental Setup

Figure 1 shows the present electrode system for generating the Quadrupole Magnetron plasmas. Coaxial magnetron plasmas can be generated by applying magnetic field by solenoid coil surrounded the cylinder vacuum chamber. Herewith, it can be expected to realize the excellent coating with long-shaped, high uniformity and high deposition rate on surface of wire. Fine wire

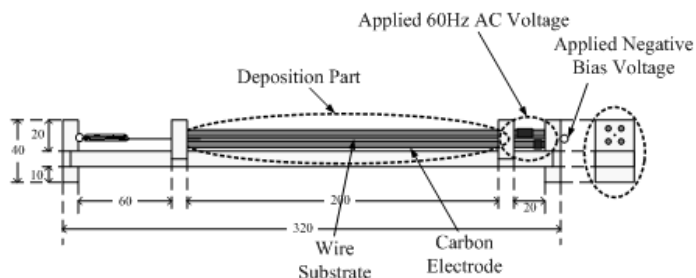


Fig.1 Electrodes system

with several 100 μ m in diameter is set to the center of quadrupole electrodes. Also the tension of the wire was kept by pulling from the one side of the wire with spring. The wire is administered mirrored surface treatment and it can be applied negative bias voltage. Alternatively, applied symmetrical AC voltage of commercial frequency of the electrodes faced to the opposite corner is equipotential. Electrode system was set up in the vacuum cylindrical chamber.

Results and Discussions

Figure 2 shows the temporal evolution of ion currents density to the wire substrate for various discharge voltages. When the discharge voltage is 300V, the ion current is decreased up to almost 0 after 15 min. deposition. Therefore, it is considered that the wire ion current is difficult to flow because the insulate films may be deposited on the wire surface.

From these experimental data, it is clearly found that the ion current was rapidly decreased and increased during the deposition when the discharge voltage was high such as 350V or 400V. The interested current up-down may be caused that the insulation films was deposited on the wire in the first stage, and in the second stage the film quality changed electrically from insulate one to conductive one.

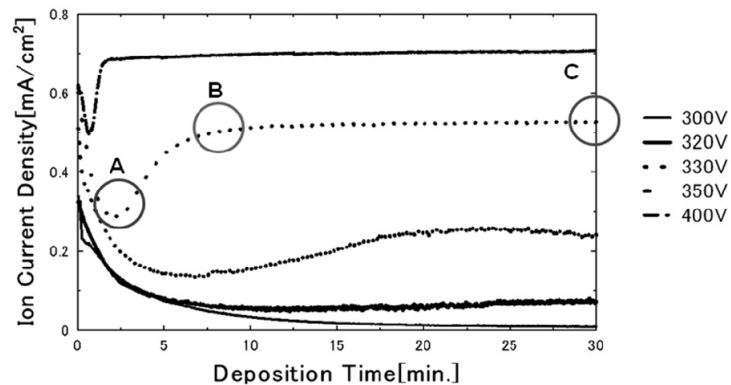


Fig.2 Temporal Evolution of Ion Current Density

Conclusions

The carbon films were deposited on the fine wire using the quadrupole magnetron plasmas. The CVD/PVD ratio of hybrid process can be changed with discharge power. For higher discharge power and after long time deposition, coated films changed to graphite like with conductive property. The cause of such change will be investigated by monitoring the substrate temperature.