DLC Inner Wall Hybrid Coating of Narrow Tubes by the 2nd Harmonic ECR Micro Plasma

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Abstract

Inner wall coating have been developed by using PVD and CVD hybrid methods to narrow tubes by the 2nd harmonic ECR micro plasma source. Here, we report on the evaluation result of the deposited carbon films by PECVD, PVD (coaxial sputtering) and hybrid methods for various gas composition ratios and gas pressures.

Introduction

Recently, a graying society has been developing in Japan, and the peoples died by causes relevant to blood vessel. Therefore, the needs such as high-quality stent and catheter have been increased. However, the thrombus is formed in stents and catheters when keeping using for a long time. So it is necessary to operate every time the thrombus is generated and to exchange it. So as the operation is attended with danger. Therefore it is necessary to give the functional thin films such as Diamond-like carbon (DLC), and to attempt making to long life. To improve uniformity and the adhesion of coated thin film in the narrow tube inner coating, the present study proposes the hybrid method using the coaxial sputtering method together with the PECVD method for the lower pressure conditions.

Experimental

In our previous researches, it has been shown that plasma generation in narrow tube can be possible by using the 2nd Harmonic ECR. It was able to be generated even for low-pressures at short gap length. We tried to inner wall carbon coating to narrow tube of 6mm in a diameter by the PECVD method, the coaxial sputtering method and hybrid

Table.1. Experimental Condition

Target(Carbon Rod)		3.0	[mm$^{\varphi}$]
Substrate(Glass Tube)		6	[mm$^{\varphi}$]
Gap Length		1.5	[mm]
Gas	C_2H_4	2	[sccm]
	Ar		
Pressure		100	[mTorr]
Microwave Power		20	[W]
RF Self Bias		-50	[V]
Pulse Bias		-400	[V]
Magnetic Field		438	[Gauss]
Coating Time		10	[min]

method in experimental conditions shown in Table.1.

The experimental setup is shown in Fig.1. The carbon used to inner electrode, it setup in the coaxial electrode. The C_2H_4 gas and the Ar gas were injected to the chamber that had exhausted to 10^{-6}Torr with the turbo-molecular pump and the rotary pump, and the micro wave of 2.45GHz was entered into an inside electrode in the TEM mode. The impressed current of two solenoid coils was adjusted, and 2nd harmonic ECR micro plasma was generated in the resonance condition of 438Gauss.

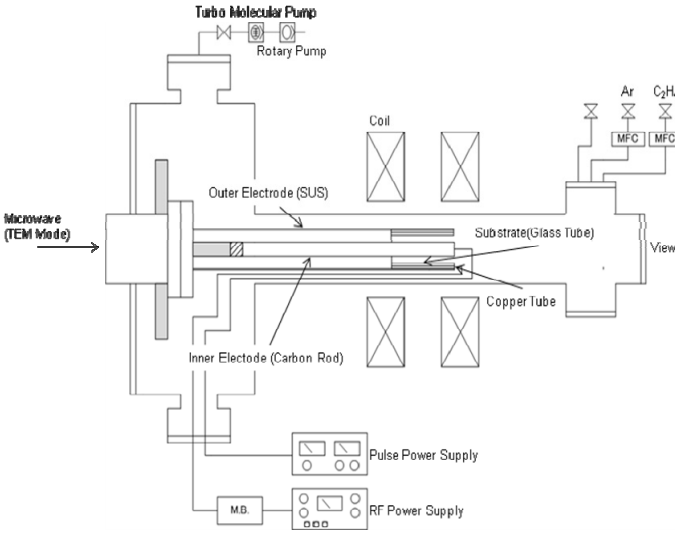

Fig.1. Experimental Setup

Results and Discussions

The Raman spectra of each sample that was compared is shown in Fig.5. D peak and G peak were observed from the Raman spectrum of each Figure near 1360cm^{-1} and 1580 cm^{-1}. In Fig.5, the Raman spectrum of the coaxial sputtering method is quite sharp. The degree of ionization rises because of the operation gas of Ar 100%, and the substrate temperature rise. So it is considered that graphite advanced.

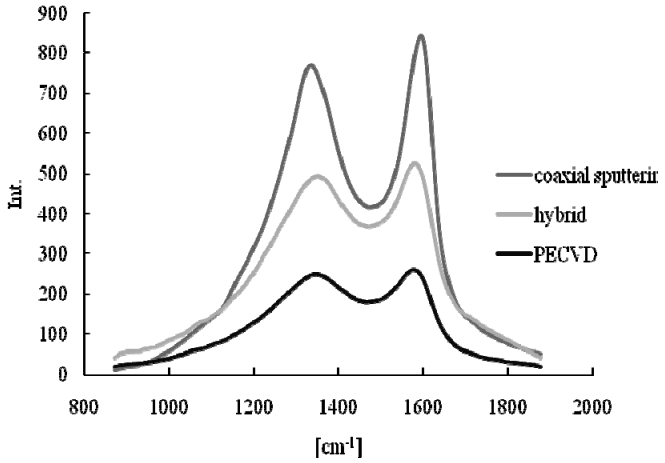

Fig.2. Comparison of Raman Spectrum

Conclusions

Trial coating has been performed by using the PECVD method, the coaxial sputtering method, and the hybrid method. As a result, DLC thin film was successfully deposited. And in the coaxial sputtering method, it is especially thought that graphite advanced.