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ハイパワーインパルスマグネトロンスパッタリングを用いた Si含有DLC膜の成膜
Deposition of Si-doped DLC film using high power impulse magnetron sputtering

[1]三輪　侑生，[2]小田　昭紀，[3]上坂　裕之，[1]太田　貴之
[1]Yuki Miwa, [2]Akinori Oda, [3]Hiroyuki Kousaka, [1]Takayuki Ohta

[1]名城大理工，[2]千葉工大，[3]岐阜大工
[1]Meijo Univ., [2]Chiba Inst. Technol., [3]Gifu Univ.

1. Introduction

Diamond-Like Carbon (DLC) film has been attracted attention as a surface coating material due to some good properties such as high hardness, low friction, high chemical stability and so on. It has been reported that a silicon-doped DLC (Si-DLC) film shows lower friction coefficient than a non-doped DLC film[1)]. In addition, a hydrogen-free DLC film deposited by using the physical vapor deposition (PVD) methods can also realize a reduction of the friction coefficient[2)]. High power impulse magnetron sputtering (HiPIMS), which is generated by a high peak power density with a short pulse applying to a target cathode, realizes a smooth surface, good adhesion and a very dense film due to high ionization rate of the target particles[3)].

In this study, hydrogen-free Si-DLC film was deposited by a dual magnetron sputtering method using Si and C targets to reduce the friction coefficient. The mechanical and structural properties of the Si-DLC film were investigated by varying silicon content in the film.

2. Experimental method

HiPIMS power source and RF power source were connected to the carbon and silicon targets, respectively. The flow rate of Ar gas was 4sccm and the total pressure was 0.5Pa. Substrate bias voltage was -100V, and the distance between the target and the substrate was 84mm. The ball-on-disc friction-test was carried out using a steel ball (SUJ2) as a mating material under the condition; humidity of 50%, load of 1N, sliding radius of 2mm, and rotation speed of 200rpm.

3. Results

Fig. 1 shows the friction coefficient as a function of RF power. The friction coefficient decreased to be 0.074 with increasing the RF power up to 25W. The friction coefficient increased and the Si-DLC film was worn off from the substrate during the friction test at RF power of 30W.

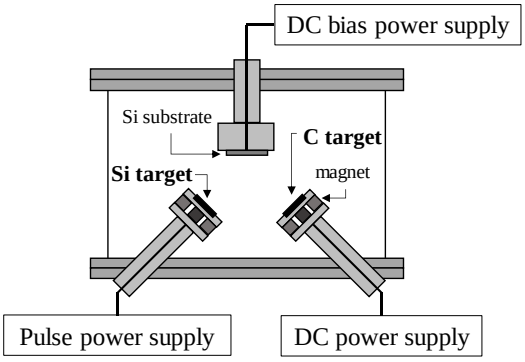

Fig.1 Schematic diagram of dual magnetron sputtering apparatus.

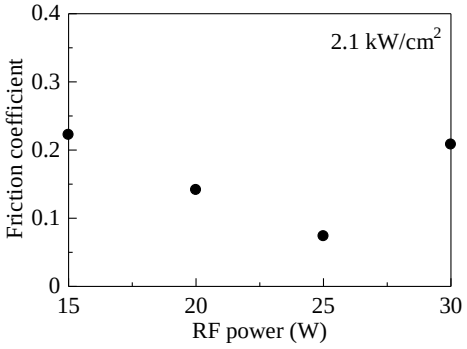

Fig.2 Friction coefficient of Si-DLC films as a function of RF power.

References

1) H. Mori et al., J. Surf. Finish. Soc. Jpn., 59, 401(2008).
2) M. Tsujioka, J. Surf. Finish. Soc. Jpn., 63, 134(2012).
3) A. P. Ehiasarian et al., Pure Appl. Chem., 82, 1247(2010).