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Hideki Nakazawa, Ryosuke Kamata, Soushi Miura, Saori Okuno

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Hideki Nakazawa*, Ryosuke Kamata, Soushi Miura, Saori Okuno

Graduate School of Science and Technology, Hirosaki University, 3 Bunkyo, Hirosaki, Aomori 036-8561, Japan

ABSTRACT

We have investigated the effects of the frequency of pulsed substrate bias on the structure and properties of Si-doped diamond-like carbon (Si-DLC) films deposited by radio-frequency plasma-enhanced chemical vapor deposition using CH_4, Ar, and monomethylsilane (CH_3SiH_3) as the Si source. The Si/(Si+C) ratios in the Si-DLC films deposited using pulsed bias were higher than that of the dc-biased Si-DLC film, and the Si fraction increased with decreasing frequency. Fourier transform infrared spectroscopy and X-ray photoelectron spectroscopy analyses revealed that Si-C, Si-H_n, and C-H_n bonds in the Si-DLC films increased with decreasing frequency. The internal stress decreased as the frequency decreased, which is probably due to the increase in Si-C, Si-H_n, and C-H_n bonds in the films. It was found that the wear rate of the pulse-biased Si-DLC film deposited at the highest frequency in this study is comparable to that of the dc-biased, undoped DLC film. Furthermore, the friction coefficient of the former is about one third of that of the latter.

Keywords: diamond-like carbon; silicon; pulsed substrate bias; adhesion; friction; wear

*Corresponding author. Tel.: +81-172-393557; fax: +81-172-393557.

E-mail address: hnaka@cc.hirosaki-u.ac.jp (Hideki Nakazawa).