

## Accepted Manuscript

Achieving low friction and wear under various humidity conditions by co-doping nitrogen and silicon into diamond-like carbon films

Teng Chen, Xinyang Wu, Zhou Ge, Jingjie Ruan, Bo Lv, Jianhua Zhang



PII: S0040-6090(17)30576-X  
DOI: doi: [10.1016/j.tsf.2017.07.072](https://doi.org/10.1016/j.tsf.2017.07.072)  
Reference: TSF 36138  
To appear in: *Thin Solid Films*  
Received date: 24 January 2017  
Revised date: 27 July 2017  
Accepted date: 28 July 2017

Please cite this article as: Teng Chen, Xinyang Wu, Zhou Ge, Jingjie Ruan, Bo Lv, Jianhua Zhang , Achieving low friction and wear under various humidity conditions by co-doping nitrogen and silicon into diamond-like carbon films, *Thin Solid Films* (2017), doi: [10.1016/j.tsf.2017.07.072](https://doi.org/10.1016/j.tsf.2017.07.072)

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Achieving Low Friction and Wear under Various Humidity Conditions by Co-doping Nitrogen and Silicon into Diamond-like carbon Films

Teng Chen, Xingyang Wu, Zhou Ge, Jingjie Ruan, Bo Lv, Jianhua Zhang\*

School of Mechatronic Engineering and Automation, Shanghai University,

149 Yanchang Road, Shanghai 200072, China

**Abstract:** Nitrogen and silicon co-incorporated DLC (N-Si-DLC) films were deposited by RF-CVD method, and the humidity effect on the tribological properties was investigated by a ball-on-disk type reciprocating tribometer in air environments at the relative humidity of 15, 45 and 75 %. The chemical state of the elements and the bonding configurations were determined by X-ray photoelectron spectroscopy (XPS), Raman spectroscopy, and Fourier transform infrared (FTIR) spectroscopy. Nano-indentation tests were performed to measure the hardness and modulus. The internal stress of the films was calculated by the Stoney equation. The characterization results showed that the N and Si contents were in the range of 4.4-10.3 at.% and 7.5-8.7 at.%, respectively. By co-doping N and Si, the internal stress of the films was reduced markedly, although with a slight reduction in the hardness and modulus. The N-Si-DLC films co-doped with a small amount of N exhibited lower friction and wear compared with the Si-DLC films without doping N. Also, these films showed low frictional sensitivity to the environmental humidity. The formation of C=N and C≡N groups with strong electron withdrawing ability is thought to contribute to reducing the friction and wear, since they are strong electron acceptors which can reduce the electron density and nucleophilic reactivity of the dangling bonds formed on the film surface during sliding.

**Key words:** Diamond-like carbon; Nitrogen co-incorporated; Si-DLC; Humidity; Electron acceptor

---

\* Corresponding author. E-mail: jhzhang@staff.shu.edu.cn

Download English Version:

<https://daneshyari.com/en/article/5465883>

Download Persian Version:

<https://daneshyari.com/article/5465883>

[Daneshyari.com](https://daneshyari.com)