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# Characterization and Tribological Properties of Rice Husk Carbon Nanoparticles Co-doped with Sulfur and Nitrogen

Bangbang Wang<sup>1</sup>, Enzhu Hu<sup>2\*</sup>, Zhiqiang Tu<sup>2</sup>, Karl Dearn David<sup>3</sup>, Kunhong Hu<sup>2</sup>, Xianguo Hu<sup>1</sup>,  
Wei Yang<sup>2</sup>, Jianhua Guo<sup>2</sup>, Weimeng Cai<sup>2</sup>, Wenli Qian<sup>2</sup>, Hao Zhang<sup>2</sup>

(1. School of Mechanical Engineering, Institute of Tribology, Hefei University of Technology, 193 Tunxi Road, Hefei 230009, PR. China 2. Department of Chemical and Materials Engineering, Hefei University, 99 Jinxiu Road, Hefei 230601, PR. China 3. Mason Institute of Tribology, Department of Mechanical Engineering, University of Birmingham, Edgbaston, Birmingham, B15 2TT, United Kingdom )

## Abstract:

A novel carbon nanoparticle co-doped with sulfur and nitrogen (S, N–CN) was prepared from rice husk powder through a hydrothermal reaction. A series of modern analysis techniques was utilized to characterize the morphology, structure, and components of the S, N–CN nanoparticles. Their tribological properties as a lubricating additive to polyethylene glycol (PEG200) base oil were investigated using a UMT-2 sliding tribometer. Results showed that the average diameter of nanoparticles were approximately 16 nm. The nanoparticles mainly included C, O, N, and S. The  $I_D/I_G$  value of S, N–CN was 2.63. PEG200 that included different contents of S, N–CN displayed remarkable lubricating performance compared with pure PEG200 under different loads (8, 20, 40, and 100 N). When 0.1 wt% S, N–CN was dispersed in base oil, the friction coefficient and wear rate decreased by 16.6% and 75.9%, respectively. The friction and wear mechanisms were attributed to robust tribo-films that had developed as a result of tribo-chemical reactions induced by the S, N–CN particles, comprising nitrides, sulfides, and metal oxides to promote wear resistance and friction reduction properties of PEG200.

Key words: Rice husk, Hydrothermal reaction, Nanoparticles, Friction and wear<sup>1</sup>

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<sup>1</sup> \* Corresponding author: Tel.: +86 551 62158439  
E-mail address: [huez@hfuu.edu.cn](mailto:huez@hfuu.edu.cn), [huenzhu7@163.com](mailto:huenzhu7@163.com) (E. Hu)

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