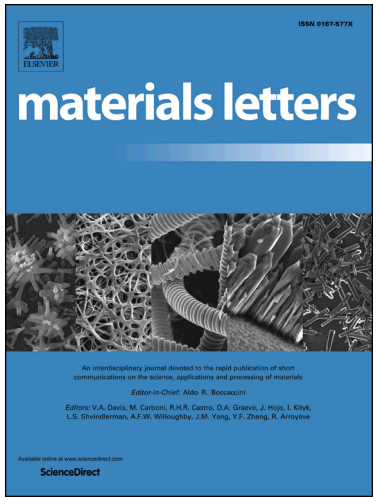

Measurement on critical shear stress of circular point contact utilizing Atomic Force Microscope

Xinyang Yan, Jinfeng Peng, Sisi Liu, Yinmin Wang, Xuejun Zheng

PII: S0167-577X(18)30425-7
DOI: https://doi.org/10.1016/j.matlet.2018.03.061
Reference: MLBLUE 24022

To appear in: *Materials Letters*

Received Date: 20 January 2018
Revised Date: 7 March 2018
Accepted Date: 8 March 2018

Please cite this article as: X. Yan, J. Peng, S. Liu, Y. Wang, X. Zheng, Measurement on critical shear stress of circular point contact utilizing Atomic Force Microscope, *Materials Letters* (2018), doi: https://doi.org/10.1016/j.matlet.2018.03.061

Measurement on critical shear stress of circular point contact utilizing Atomic Force Microscope

Xinyang Yan, Jinfeng Peng, Sisi Liu, Yinmin Wang, Xuejun Zheng*

School of Mechanical Engineering, Engineering Research Center of Complex Tracks Processing Technology and Equipment of Ministry of Education, Key Laboratory of Welding Robot and Application Technology of Hunan Province, Xiangtan University, Xiangtan, 411105, People's Republic of China

Abstract

We propose Bowdon-Johnson-Kendall-Roberts model to measure the critical shear stress of circular point contact, and the critical shear stress map is constructed through the lateral force mode and force map mode of Atomic Force Microscope to research the interface property of nanomaterials. The mean critical shear stresses are measured as 0.24 MPa for monolayer MoS_2 and 0.69 MPa for graphene. MoS_2 nanosheet and graphene are of the lower critical shear stress and friction coefficient than those of the bulk materials, which are good agreement with the regularities in nanotribology. The critical shear stress can be used to not only quantitatively characterize the frictional properties, but also analyze the friction at different loading stages. The critical shear stress map would play an important role in sliding contact of nanomaterials for the drive part design and nanotribological reliability of nanoelectronic mechanical system.

Keywords：Atomic Force Microscope, Wear and tribology, Interfaces.

1. Introduction

Due to the large surface-to-volume ratio and strong surface effect, there are distinguishing friction behaviors between nanomaterials and bulk materials, therefore the traditional tribological theory and experimental method are no longer suitable for nanotribology [1]. The friction coefficient can be obtained by using linear fitting to describe frictional property of nanomaterials, but the evaluated results are

* Author to whom correspondence should be addressed. Electronic mail: zhengxuejun@xtu.edu.cn.