### Accepted Manuscript

WC-Ni-Cr-based self-lubricating composites fabricated by pulsed electric current sintering with addition of WS2 solid lubricant

Xin-yang Huang, Jin-hua Wang, Hai-quan Zhang, Jing Ren, Qing-feng Zan, Qian-ming Gong, Bin Wu

PII: S0263-4368(17)30059-8

DOI: doi: 10.1016/j.ijrmhm.2017.03.013

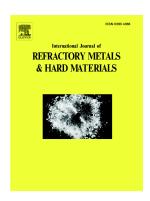
Reference: RMHM 4434

To appear in: International Journal of Refractory Metals and Hard Materials

Received date: 2 February 2017 Revised date: 18 March 2017 Accepted date: 21 March 2017

Please cite this article as: Xin-yang Huang, Jin-hua Wang, Hai-quan Zhang, Jing Ren, Qing-feng Zan, Qian-ming Gong, Bin Wu, WC-Ni-Cr-based self-lubricating composites fabricated by pulsed electric current sintering with addition of WS2 solid lubricant. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Rmhm(2017), doi: 10.1016/j.ijrmhm.2017.03.013

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.



## **ACCEPTED MANUSCRIPT**

# WC-Ni-Cr-based self-lubricating composites fabricated by pulsed electric current sintering with addition of WS<sub>2</sub> solid lubricant

Xin-yang Huang<sup>a,b</sup>, Jin-hua Wang<sup>a,b</sup>, Hai-quan Zhang<sup>a,b</sup>, Jing Ren<sup>c</sup>, Qing-feng Zan<sup>a,d</sup>, Qian-ming Gong<sup>e</sup>, Bin Wu

<sub>a,b,\*</sub>

\* Corresponding author: wu-bin@tsinghua.edu.cn

#### ABSTRACT

Self-lubricated WC-Ni-Cr-based composites with  $WS_2$  were fabricated by pulsed electric current sintering at different temperatures and pressures. The density and hardness of the composites were investigated, and the densification effects of sintering temperature and pressure were discussed. The applied pressure over 250 MPa along with a sintering temperature as low as 950 °C could densify the sintered composite while protecting the disulfide from decomposition. The tribological properties of the composites were also tested under sliding wear conditions in air. The composite with  $WS_2$  sintered under high pressure could provide a lower friction coefficient than WC-Ni-Cr cermet without the addition of  $WS_2$ . The test results are discussed together with the morphology of the polished surfaces and wear tracks. The presence of  $WS_2$  and sulfur element in the composites was analyzed with the help of scanning electron microscopy, Raman spectroscopy and energy-dispersive X-ray spectroscopy.  $WS_2$  in the composite appears to be transferred to the contact area with other wear debris during sliding and reduces the friction coefficient.

Keywords: cermet; disulfide; spark plasma sintering; hardness; anti-wear; self-lubrication

#### 1 Introduction

WC-based cermets could serve as bearing parts and mechanical face seals in ionizing radiation fields [1]. However, their coefficients of friction (COFs) under dry sliding conditions [2] still need to be lowered to extend the service life. Various solid lubricants such as fluorides [3,4] and graphite [5] have been introduced into the WC-based self-lubricating composites to reduce friction and wear. Besides, MoS<sub>2</sub> and WS<sub>2</sub> are also excellent solid lubricants with even better lubricating performance. To date, however, they are mainly mixed into WC-based powders to prepare coatings by spraying. Few studies on the preparation of self-lubricating composite bulk materials with disulfide lubricants distributed throughout the body have been reported.

Self-lubricating composite bulk materials with disulfide lubricants could have longer endurance than the coatings, although the preparation by powder metallurgy methods would be rather difficult [6]. Powder metallurgy method is a practical way to prepare hard composites with addition of cemented carbides [7] without melting or casting processes,

<sup>&</sup>lt;sup>a</sup> Institute of Nuclear and New Energy Technology, Collaborative Innovation Center of Advanced Nuclear Energy Technology, Tsinghua University, Beijing 100084, China

<sup>&</sup>lt;sup>b</sup> The Key Laboratory of Advanced Reactor Engineering and Safety, Ministry of Education, Beijing 100084, China

<sup>&</sup>lt;sup>c</sup> State Key Laboratory of Tribology, Department of Mechanical Engineering, Tsinghua University, Beijing 100084, China

<sup>&</sup>lt;sup>d</sup> Beijing Key Laboratory of Fine Ceramics, Institute of Nuclear and New Energy Technology, Tsinghua University, Beijing 100084, China

<sup>&</sup>lt;sup>e</sup> School of Materials Science and Engineering, Tsinghua University, Beijing 100084, China

#### Download English Version:

## https://daneshyari.com/en/article/5457776

Download Persian Version:

https://daneshyari.com/article/5457776

<u>Daneshyari.com</u>