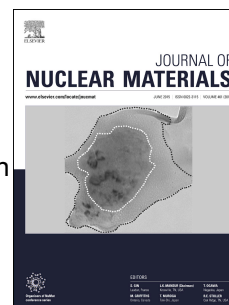


Accepted Manuscript

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PII: S0022-3115(18)30923-1

DOI: [10.1016/j.jnucmat.2018.10.014](https://doi.org/10.1016/j.jnucmat.2018.10.014)

Reference: NUMA 51253

To appear in: *Journal of Nuclear Materials*

Received Date: 5 July 2018

Revised Date: 25 September 2018

Accepted Date: 9 October 2018

Please cite this article as: L.-L. Niu, Q. Peng, F. Gao, Z. Chen, Y. Zhang, G.-H. Lu, Effects of interstitial defects on stress-driven grain boundary migration in bcc tungsten, *Journal of Nuclear Materials* (2018), doi: <https://doi.org/10.1016/j.jnucmat.2018.10.014>.

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Effects of interstitial defects on stress-driven grain boundary migration in bcc tungsten

Liang-Liang Niu^a, Qing Peng^b, Fei Gao^b, Zhe Chen^c, Ying Zhang^{d,*}, Guang-Hong Lu^d

^a*Institute of Chemical Materials, Chinese Academy of Engineering Physics, Mianyang 621999, China*

^b*Department of Nuclear Engineering and Radiological Science, University of Michigan, Ann Arbor, MI 48109, USA.*

^c*Southwestern Institute of Physics, P.O. Box 432, Chengdu 610041, China*

^d*Department of Physics, Beihang University, Beijing 100191, China.*

Abstract

We demonstrate via atomistic simulations that the addition of interstitial defects, either self-interstitials or helium can induce jog formation at grain boundary dislocations in bcc tungsten. For the two typical GBs with distinct dislocation structures, we show that the critical stress for stress-driven grain boundary migration is governed by the competition between the impeding effect of vacancy/helium and the facilitating effect of jogs depending on the grain boundary character, thus yielding different response of critical stress to defect concentrations. Specifically, for self-interstitials, the impeding effect of nucleated vacancies dominates in the $\Sigma 85$ GB, while the facilitating effect of jogs dominates in the $\Sigma 13$ GB; for helium, the impeding effect of helium plays a dominant role in both GBs. Moreover, we reveal a transition from coupled migration to pure sliding at high helium concentrations.

*Corresponding author.

E-mail address: zhyi@buaa.edu.cn (Y. Zhang).

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