Accepted Manuscript

La doping inhibits stress production at the grain boundaries in Ni–WC coating

Xiao Wang, Ju Rong, Yuhan Yao, Yannan Zhang, Yi Zhong, Jing Feng, Xiaohua Yu, Zhaolin Zhan

PII: S0925-8388(18)31592-5

DOI: 10.1016/j.jallcom.2018.04.269

Reference: JALCOM 45907

To appear in: *Journal of Alloys and Compounds*

Received Date: 12 February 2018

Revised Date: 22 April 2018

Accepted Date: 23 April 2018

Please cite this article as: X. Wang, J. Rong, Y. Yao, Y. Zhang, Y. Zhong, J. Feng, X. Yu, Z. Zhan, La doping inhibits stress production at the grain boundaries in Ni–WC coating, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.04.269.

La doping inhibits stress production at the grain boundaries in Ni–WC coating

Xiao Wang[a], Ju Rong[a], Yuhan Yao[a], Yannan Zhang[a], Yi Zhong[a], Jing Feng[a], Xiaohua Yu[b,*], Zhaolin Zhan[a,*]

a. Faculty of Material Science and Engineering, Kunming University of Science and Technology, Kunming 650093, China.

b. Solid Waste Utilization National Engineering Center, Kunming University of Science and Technology, Kunming 650093, China.

Abstract: Ni–WC–La_2O_3 wear-resistant coatings are prepared by a plasma spray method on the pure iron. The microstructure and wear resistance of the coating are investigated. After La_2O_3 doping, the wear resistance of modified coating was enhanced significantly. The amount of coating wear was reduced by 61.9% and the friction coefficient was reduced by 35.7% because of the La_2O_3 content of 1.5 wt.% compared with the Ni–WC coating. La_2O_3 can suppress WC precipitation along the grain boundaries, and reduce the number of cracks in the substrate near the WC phase. Furthermore, the diffusion and segregation behavior of La atoms is studied by first-principle calculation. The simulation results show that La doping can increase the bonding energy between the WC particles and the Ni substrate, consequently improve the abrasion properties of the coating. The cohesive energy of the interface is the smallest when the La atoms occupies Ni atomic sites of the interface, as result a stable Ni–WC interface is formed on the interface. A Ni–La amorphous transition layer is

* Corresponding author.

E-mail address: zl_zhan@sohu.com (Zhaolin Zhan), xiaohua_y@163.com (Xiaohua Yu)