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Yue Dong [a,c], Fangfang Ge [a, b]*, Fanping Meng [a, b], Gongshu Zhao [a, b], Jie Zhou [a], Zhaoping Deng [c], Qing Huang [a], Feng Huang [a, b]*

[a] *Engineering Laboratory of Specialty Fibers and Nuclear Energy Materials, Ningbo Institute of Industrial Technology, Chinese Academy of Sciences, Ningbo, China 315201*

[b.] *Key Laboratory of Marine Materials and Related Technologies, Zhejiang Key Laboratory of Marine Materials and Protective Technologies, Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences, Ningbo, China 315201*

[c] *College of Materials and Chemistry & Chemical Engineering, Chengdu University of Technology, Chengdu, China 610059*

Abstract

Accident tolerant fuel claddings are extremely urgent to increase the safety margin of light water reactors. In this work, Cr-Al-Si ternary alloy coatings were proposed to increase high-temperature oxidation resistance of zirconium claddings. $Cr_{62.8}Al_{27.9}Si_{9.3}$ coatings were deposited on Zr coupons by magnetron sputtering, followed by evaluation of their oxidation resistance and adhesion strength under high-temperature steam. No oxidation of the Zr coupons underneath the coatings occurred in the 1000 °C steam for 15 min. In the 1200 °C steam for 30 min, both the weight gain and the thickness of the α-Zr(O) layer decreased 40% and 50%, related to those of the uncoated coupons, respectively. Moreover, the adhesion of coating and substrate was improved after the high-temperature oxidation, with the adhesion strength of the oxidized coating – Zr substrate more than ~50 N. It was further observed that the Al and Si atoms preferentially diffused outwards the surface to form a layer of oxides, and

* Correspondence author (gefangfang@nimte.ac.cn). Tel: 86-574-86685035; Fax: 86-574-86685159

* Correspondence author (huangfeng@nimte.ac.cn). Tel: 86-574-86685930; Fax: 86-574-86685159