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He behavior in Ni and Ni-based equiatomic solid solution alloy

Zhanfeng Yan[1], Shaoshuai Liu[1], Songqin Xia[3], Yong Zhang[3], Yugang Wang[1], Tengfei Yang[2,1]*

[1] *State Key Laboratory of Nuclear Physics and Technology, Center for Applied Physics and Technology, Peking University, Beijing 100871, China*

[2]*Department of Nuclear Engineering, University of Tennessee, Knoxville, Tennessee 37996, USA*

[3]*State Key Laboratory for Advanced Metals and Materials, University of Science and Technology Beijing, Beijing 100083, China*

Abstract

In the current work, pure nickel (99.99 wt.%) and Ni-containing single phase equiatomic solid solution alloy Fe-Co-Cr-Ni were irradiated with 190 keV He ions at room temperature with different fluences and He behavior in both materials are compared. At 1×10^{17} cm^{-2}, TEM observation reveals that only isolated and small He bubbles (1-2 nm) are formed in Fe-Co-Cr-Ni alloy while many small suspected "string"-like He bubbles are observed in nickel at the concentration peak region (5.5 at.%). When the fluence is increased to 5×10^{17} cm^{-2}, average bubble size in nickel increases to ~8 nm which is almost equal to that in Fe-Co-Cr-Ni, but a higher bubble density is observed in nickel. At the highest dose of 1×10^{18} cm^{-2}, numerous surface blisters and exfoliations occur in nickel which are consistent with TEM observation, while the Fe-Co-Cr-Ni alloy only shows a slight surface blister. Bubble coarsening upon annealing at 500° C (2 hours) is observed at 5×10^{17} cm^{-2} in both alloys, but a