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EFFECTS OF TEMPERATURE AND HE CONCENTRATION ON FORMATION AND GROWTH OF HE BUBBLE IN BCC IRON UNDER IRRADIATION

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Helium atoms, produced at high rates in steels in fusion environment, are inclined to be deeply trapped in small vacancy clusters and microstructural features due to its low solubility in metal. Eventually, the formation of He bubbles significantly degrades the mechanical properties of materials. Therefore, it is important to understand the nucleation of He bubbles in steels, both in the bulk and within microstructural features, especially under irradiation.
In this presentation, the irradiation cascade damage process was simulated by molecular dynamics (MD) methods to investigate the formation and growth of He bubble in BCC iron under irradiation in which the energy of PKA is up to 200 keV. The effects of temperature and He concentration were analyzed. The temperature ranges from 300 K to 800 K. He atoms are randomly inserted into the iron matrix, either in tetrahedral or octahedral positions, and the corresponding He concentration is from 1000 appm to 3000 appm. The results distinctly show that the number of He-V clusters increases with increasing the PKA energy and dislocation loops with different types and sizes are produced. The formation and growth of He bubble is obviously faster with higher temperature and larger He concentration, respectively. Furthermore, the size of He bubble is almost distributed as the Gaussian distribution.

Eligible for student paper award?

Yes

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