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Study of Irradiation Damage Induced by Helium Ion in Fe-based Metallic Glass XIANXIU MEI, XIAONAN ZHANG, JIANBING QIANG, YOUNIAN WANG, Dalian University of Technology, KEY LABORATORY OF MATERIALS MODIFICATION BY LASER, ION AND ELECTRON BEAMS TEAM —
The changes in structure and surface morphology of metallic glasses $Fe_{80}Si_{7.43}B_{12.57}$ and $Fe_{68}Zr_7B_{25}$ before and after the irradiation of He ions with the energy of 300keV were investigated, and were compared with that of the tungsten. In metallic glass $Fe_{80}Si_{7.43}B_{12.57}$, when the fluence of He ions was up to 410^{17}ions/cm^2 (19dpa), crystallization occurred, and a small amount of metastable β-Mn type phase nanocrystals formed. When the fluence increased to 110^{18}ions/cm^2 (47dpa), the quantity of nanocrystals increased and metastable β-Mn type phase transformed into α-Fe phase and tetragonal Fe_2B phase. Then orthogonal Fe_3B phase and β-Mn type phase formed and were added to the nanocrystals as the fluence increased to 1.610^{18}ions/cm^2(69dpa), while metallic glass $Fe_{68}Zr_7B_{25}$ maintained amorphous under the He ion irradiation, till the fluence was up to 1.610^{18}ions/cm^2 (69dpa). This indicates that the irradiation resistance of $Fe_{68}Zr_7B_{25}$ is better. After the irradiation, different damage morphologies were exhibited on the surfaces of the two kinds of Fe-based metallic glasses. When the fluence was 1.610^{18}ions/cm^2, cracks and ductile shear steps appeared on the surface of metallic glass $Fe_{80}Si_{7.43}B_{12.57}$, and spalling as well as brittle fracture morphology appeared on the surface of metallic glass $Fe_{68}Zr_7B_{25}$. However, blisters and spallings occured on the surface of tungsten at the irradiation fluence of 110^{18}ions/cm^2, and with the increase of irradiation fluence, the spalling phenomenon became more serious. Thus the irradiation resistance of Fe-based metallic glasses is better than that of tungsten.

Xianxiu Mei
Dalian University of Technology

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