
Effects of High-intensity Pulsed Ion Beam Irradiation on the Structural Thermal Stability of Fe-based and Ni-based Metallic Glasses

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Metallic glasses are considered to have good resistance to irradiation because of their long range disordered structure and the existence of abundant free volume. Due to the unique characteristics of high-intensity pulsed ion beam (HIPIB) such as high ion current, short pulse, high kinetic ion energy, HIPIB irradiation technology could be used to study the thermal irradiation damage of metallic glass. HIPIB with different energy density and pulse number was used to irradiate metallic glasses $\text{Fe}_{80}\text{Si}_{7.43}\text{B}_{12.57}$ and $\text{Ni}_{62}\text{Ta}_{38}$ to study the structural thermal stability of the metallic glasses. After their irradiation with the impulse number of 300 and the energy density of $0.32\text{J}/\text{cm}^2$, a large number of roundholes and a few "bumps" appeared on the surfaces of the metallic glasses and no radiation damage such as cracks occurred. Under the HIPIB irradiation, the Fe-based and Ni-based metallic glasses remained amorphous, while the arrangement of atomic structure in the sub-surfaces of metallic glasses became more disordered: irradiation induced strong migration and aggregation of atoms inside the metallic glass, making the atomic arrangement uneven. After the irradiation, the surface reflectance of the Fe-based metallic glass decreased slightly. The number of impulses had greater impact on Fe-based metallic glass than energy density. Fe-based and Ni-based metallic glasses have good heat radiation resistance and structural thermal stability.

This work was supported by the National Science Foundation of China (No. 11675035 and No. 11375037).