第15卷 第2,3期 广东有色金属学报 Vol. 15, No. 2,3
2005年9月 JOURNAL OF GUANGDONG NON-FERROUS METALS Sep 2005

Article ID: 1003-7837(2005)02,03-0418-01

Development of low-activation alloys on the basis of V-Ga-Si for thermonuclear power

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Influence of additives of silicon (up to 1.2%, at. fraction) on properties of alloys V-(3.4-3.6)%Ga (at. fraction) was investigated. These alloys are developed as constructional low-activation materials for thermonuclear reactors. According to X-ray o and the microstructural analysis limiting solubility of silicon in given alloys is certain as 0.7-0.75%(at. fraction). It is shown, that alloying binary V-Ga alloys by silicon within the solid solution limits leads to considerable increase of mechanical properties as at room (σ_B= 450-470 MPa), and at raised temperatures (σ_B=340 MPa at 600℃), and retain the sufficient level of plasticity (δ=22%-26%). Comparison of the received values of strength and plasticity of the investigated alloys to corresponding data for known alloy V-4Ti-4Cr at 200℃ and 600℃ shows, that they have close values. So, at 600℃ for alloy V-3.39Ga-0.62Si $\sigma_в$=336 MPa and δ=26.2%, and for V-4Ti-4Cr $\sigma_в$=370 MPa and δ=20%. At the same time the total contents of alloying elements for V-3.4%(at. fraction) Ga-0.62% (at. fraction) Si is roughly 4%(at. fraction), and for V-4Ti-4Cr its 8%(at. fraction). Lower total percent of alloying elements in of V-Ga-Si system alloys as compared with V-Ti-Cr system alloys at achievement of practically identical level of strength and plasticity has positive value. It is especially important for reduction of amount of radioactive elements transmutant, in particular gas, with arising during an irradiation in nuclear reactors. Their quantity and composition will define the activity of alloys and speed of its decay after operational period that matters for a choice of conditions of their recycling.

Received date: 2005-08-29