

Microstructure and mechanical properties of the Al90Gd10 alloy after barothermal treatment

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Using the methods of microindentation, X-ray diffraction analysis, optical and electron microscopy the comparative studies of the microstructure and bulk physical and mechanical properties (microhardness, reduced modulus of elasticity, plasticity index, elastic recovery parameter, stiffness, etc.) of samples of the binary hypereutectic Al90Gd10 alloy (hereinafter, atomic percent) were performed. The first sample was obtained by rapid cooling of the melt at the rate of 1000 deg/s under high pressure of 10 GPa, the hardening temperature was 1800 K. The second sample was obtained by pressing the original sample at high pressure of 5 GPa without melting. Compared to the original sample, the microstructure of both samples is crushed and compacted. The structure of the initial sample is represented by two equilibrium phases, Al and Al₃Gd. It was found in the sample without melting, in addition to the Al and Al₃Gd phases, there is a phase with the composition Gd_{54.6}Al_{45.4}, which has an almost 10-fold increase in hardness (GPa) and reduced modulus of elasticity (GPa) relative to the average value of sample hardness (1.28 GPa). In the sample with melting, an Al-enriched phase with the composition Al_{91.5}Gd_{8.5} was found. The average hardness of the sample with melting (excluding the Gd_{54.6}Al_{45.4} phase) is 1.2 times higher than in the sample pressed without heating.

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