

Phase formation in aluminum alloys aged in the constant and pulse magnetic field

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In the report the results of phase formation and magnetoplastic effect (MPE) researches in five alloys on the Al-basis with additives Mg, Li, Zn, Cu, Si, Fe and Mn, aged in a constant magnetic field (CMF) and pulse magnetic field (PMF), are presented.

Preliminary the samples subjected to annealing in the furnace at the air atmosphere, then quenched in water at a room temperature. Further the quenched samples are artificial aged in vacuum in CMF and PMF and without it. Microstructure, MPE, phase content and parameters of thin structure of a residual α -matrix of samples have been investigated by methods of metallography, microhardness, X-ray structure and phase analysis.

Ageing of the Al-basis alloy without imposing magnetic field leads to increase in intensity and broadening of the diffraction lines corresponding α -solid solutions that testifies to processes of an alloy relaxation at ageing temperature.

Inclusion CMF influences on phase formation process and structure relaxation period of aged alloy to equilibrium content. Imposing CMF changes value of thin structure parameters of α -solid solutions and at that the structure of alloys at imposing CMF and at negative sign of MPE becomes more homogeneous and fine granulated. In this cases, changes of microhardness of aged alloy up to ~20 % in relation to value of microhardness of an alloy after ageing without CMF are observed. Thus, evidencing a «negative» MPE. Application of a PMF always entails a decrease in the microhardness as compared to the case of annealing in zero field by approximately 50 % and, as a result, enhanced plasticity, which suggests a «positive» MPE.

Regularities of MPE for the Al-basis alloys is assigned in connection of their structure and thermomagnetic processing. Possible physical mechanisms of MPE in investigated alloys and the modes of ageing determining them optimum physico-mechanical properties are discussed.