

Nanoobjects microscopy

Refining of intermetallic compound precipitations of transition metals during the aging of the Al-Cu-Mn-Zr alloy

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Refining of intermetallic compound precipitations of transition metals during the aging of the Al-5.8%Cu-0.3%Mn-0.1%Zr alloy has been studied using DSC, resistometry, X-ray and transmission electron microscopy. In this age-hardened alloy the nanoscale metastable phase of the Al₂Cu compound is the main strengthening phase, which is formed at low temperature aging of T = 300°C. At high temperature aging of T = 400°C during the technological heating (homogenization, heating for quenching, heating for the elimination of internal stresses etc.) refractory intermetallic compounds Al₃Zr and Al₆Mn with a size of 0.1 μm are formed. The intermetallic phases impede the recrystallization and they create additional hardening. Our studies of the aging of alloy at various multistage regimes have shown that the flat surface of the low-temperature phase can serve as the nucleation center for particles of a new intermetallic multicomponent phase, which has a cubic form and contains Al, Cu, Mn, Zr. At the same time, the density of precipitations in the matrix increases and their sizes are reduced by almost one order down to 10¹ nm in comparison with double intermetallic compounds Al₃Zr and Al₆Mn.