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Mechanisms of metastable phase transformations in Al-Cu alloys with additions of Si, Ti and B

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Different metastable phases formed during thermal treatment of Al-Cu alloys were investigated by combination of HRTEM, TEM+EDS and HRSEM techniques. The based Al - 4.97 wt. % Cu - 0.56 wt. % Ag alloy (A201) was modified by different additions of Si, Ti and B. Microstructure and mechanical properties were studied in the as-cast, solution treated (at 550˚C for ~20 hours) and aged (at 170˚C up to 32 days) conditions. The precipitation sequence during aging was the following: supersaturated solid solution (SSSS) → GP zones → θ'' → θ' + Ω → θ. During the early stages of aging GP zones are nucleated as single layers of Cu parallel to {100} planes of the α-Al matrix. Then these GP zones are united and generate the metastable θ''-$CuAl_3$ phase consisting of several single atomic layers of Cu, each of them separated by three atomic layers of Al. The Ag, Ti and B additions resulted in nucleation of metastable semi-coherent Ω phase formed at {111} α-Al planes. The Si addition increased nucleation of GP zones and inhibited Ω phase. The following aging resulted in θ'' transformation to semi-coherent metastable θ'- $CuAl_2$. The mechanism of this transformation is discussed The next step of microstructure evolution is diffusional dissolution of θ'' precipitates in the presence of more stable θ' and Ω phases. The maximum microhardness corresponded to simultaneous formation of semi-coherent θ' and Ω precipitates. After extended aging, the θ' transforms to stable incoherent BCT θ-phase.

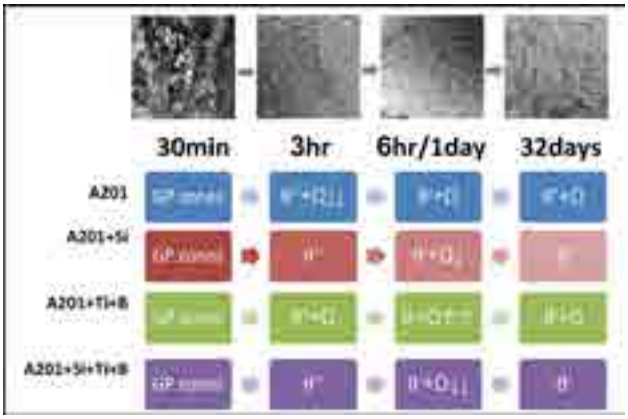

Figure 1: Summary of precipitation sequence during aging of the four A201 investigated alloys.

Biography

Alexander Katsman has completed the PhD from Ural State Technical University, Yekaterinburg, Russia in 1985. Since 2010, he has been serving as the senior researcher in Department of Materials Science and Engineering of the Technion – Israel Institute of Technology. He has published more than 70 papers in reputed journals.

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