



# Nano-size precipitates in Al-Mg-Si casting alloys after additional alloying

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## Abstract

In contrast to wrought alloys where 6XXX series are the most popular one for casting alloys 6XX. X series still not in use. Last year brought to life several Al-Mg-Si casting alloys with the composition vary from solid solution (hypoeutectic), eutectic and hypereutectic composition. Main advantage of eutectic Al-Mg-Si alloys is that the concentration of Si in  $\alpha$ -Al is very small (about 0.2 at%). This feature allows saturation of solid solution to be done. In course of investigations Cu, Zn, Sc+Zr were added to base Al-Mg-Si-Mn alloy having eutectic composition. It has been found that the addition of these elements promotes the formation of different precipitates in the Al matrix. It was found that inside of  $\alpha$  matrix there are needles of  $\Theta$  phase having average length about 6-7  $\mu\text{m}$  which was formed and grew to this dimension during heat treatment. Alloying with Zn promotes the formation of nano-size precipitates immediately after casting. Addition of Sc+Zr leads the aluminium matrix to be saturated with cubic-shaped precipitates having average size from 12 to 20 nm and density of 300  $1/\mu\text{m}^2$ . It was shown that these precipitates consist of Al, Sc and Zr and, subsequently, can be identified as  $\text{Al}_3(\text{Sc}_1\text{-XZr}_1)$ . It has been found that these precipitates remain stable during heating 573 K during 150 hours.

## 1. Introduction

In spite of development of amorphous materials, quasicrystals, advanced ceramics and foamed metals, aluminium alloys are still one of the most popular materials what yet fascinates scientists and engineers. During its history, aluminium's attractive features, such as high strength-to-weight ratio, good electrical mass conductivity,

and unique corrosion behaviour, have led to a spectacular expansion in its use. Significant cost reduction on the basic metal production level, near-to-shape fabricating methods, and well-functioning recycling system are also major contributors to aluminium success.

There are three mainstreams of scientific and engineering evolution in the area of aluminium, in particular casting, alloys:

- (i) designing of new and improving well-