

# The Formation of Eutectic Structures in Al-Si Alloys

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Al-Si alloys made from primary and recycled secondary metal are the dominant commercial aluminium casting alloys. Impurity elements associated with casting alloys can have a significant effect on grain size and defect formation. Also, there are several unintended consequences of silicon modification on the quality of castings such as porosity formation, surface finish and corrosion resistance. With the growing demand to reduce weight while also improving mechanical performance, it is important to understand which factors ensure sound refined microstructures are produced. The complete solidification sequence of these alloys is described. The formation of both the primary  $\alpha$ -Al grains and Al-Si eutectic grains are driven by an interaction between constitutional supercooling and the population of nucleant particles. Segregation of silicon at the  $\alpha$ -Al grain interface and the presence, or not, of aluminium phosphide particles determines the location of the nucleation of eutectic grains and the subsequent growth velocity which in turn controls the morphology of the silicon phase. The growth morphology and size of the eutectic grains also affects the size and distribution of ternary intermetallic phases. The addition of ternary elements, such as copper, generates a constitutionally supercooled zone ahead of the growing eutectic grains inducing the nucleation of more grains. On the other hand, increasing copper can lead to a breakdown of the modified silicon from fibrous to flake-like structures. These, sometimes competing, factors should translate to other eutectic based alloys providing a pathway for alloy development of light alloy systems.