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Temat pracy: ***Strefa działania ochładzalników zewnętrznych w odlewach ze stopów Al-Si wykonywanych w formach piaskowych***

Abstract

On account of their unique properties, aluminum-silicone alloys are one of the most popular alloys used in foundry of non-ferrous metals. This results mainly from the possibility of obtaining casts of relatively low mass, resulting from low density of aluminum-silicon alloys (Al density is 2.7 g/cm^3), whereas it still possesses good strength properties. This is the reason why aluminum-silicone alloys are commonly applied in aviation and automotive industry. Al-Si casting alloys called silumins, contain 2÷30% (most often 5÷13,5%) of silicon. They are characterized by good castability and small casting contraction, and moreover by high resistance to corrosion and abrasion. Silumins can also be multicomponent alloys, with the addition of Cu, Mg or Mn, which increase their strength. For example, hypoeutectic alloys are used for making heavily loaded elements for shipping and electric industry, used in raised temperatures and sea water. Multicomponent aluminum alloys with silicone are used, among others, for combustion engine heads and other casts used in machine industry [1].

The main factor influencing the properties of the aluminum-silicone casts is their microstructure, and most of all its grain reduction, shape_as well as the layout of structural elements. A low speed of crystallisation favours formation of coarse-grained structures and a tendency for micro- and macroporosities, which will negatively impact obtaining a cast of high technical parameters. Refining treatment, that is removing solved hydrogen from the liquid alloy, will significantly limit the occurrence of gas porosities, however it does not completely eliminate the problem connected with crystallisation process and faults caused by an incorrectly selected gating system. Obtaining a "healthy" cast with a high grain-size reduction can be conducted by applying liquid alloy refining treatments and also by an attempt to steer the crystallisation speed [2,3,4].

The ability of the casting mould to carry away the heat quickly at the crucial points of the solidifying casting allows to minimize the unfavourable effects connected with the process of slow crystallisation. The foundry technology utilizes metal moulds, which are characterized by a great ability for heat exchange. Generally, there are obtained high strength properties which are directly influenced by the crystallisation rate in the solidifying casting. In the traditional foundry, based mainly on the sand mould technology, where the crystallisation rate of the casting is relatively low, there often appear the problems of shrinkage porosity, contraction cavity which decrease the properties or even cause scrap castings.

Oxide impurities, non-metallic inclusions, porosities connected with gasification of an alloy need to be eliminated by refining, at the preparation stage of liquid casting alloy. A properly designed casting adequately situated in the mould, correctly chosen gating system or even feeders should guarantee obtaining a sound casting. Increasing the crystallisation process through applying chills makes it possible to obtain castings of the required microstructure parameters, free from faults. Speeding up the crystallisation process influences directly the casting microstructure causing its grain reduction. Thanks to that certain properties can be expected to improve, e.g hardness and tensile strength of the ready casting. Applying the chill impacts the casting wall "under the surface" of the chilling element and there the best properties of the alloy after the solidification process can be expected. Also, around the chilling device there is co called "influence zone", within which the solidified alloy should display equally good properties. Therefore, the impact of the chilling range can be established determining one or a few of the alloy's properties. This can be its density or one of its properties, e.g tensile strength of the samples taken from points placed at different distances from the edge of the chilling element edge [5,6].

Such a method of assessing an influence zone of a chilling device used for manufacturing of Al-Si castings was used in this study.