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Research Article

INFLUENCE OF ALLOYING ELEMENTS ON ALUMINUM ALLOYS

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ABSTRACT

The article analyzes the influence of alloying elements on aluminum alloys. The article examines the influence on the properties of the alloy of elements such as silicon, magnesium, copper, which the authors consider to be the main elements in an aluminum alloy.

KEYWORDS

Aluminium, silicon, magnesium, copper, oxide, germanium, nickel, alloying elements.

Introduction

Aluminum alloys are of great importance in the industry because of their amazing combination of mechanical, physical and tribological properties. These characteristics include high voltage, high abrasion resistance, setting resistance, high hardness, controlled coefficient of thermal

expansion and high temperature resistance. These properties are obtained by alloying elements, cold and heat treatment. Alloying elements are selected depending on the degree of exposure and compatibility. Alloy elements can be classified as major and minor elements,

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modifiers. microstructure and non-pure elements, although non-pure elements in some alloys may be the main element. This part of the dissertation examines the influence on the microstructure and mechanical properties of aluminum alloys of the main (si, Cu, Mg), secondary (Ni, SN), microstructural-modifying elements (Ti, B, SR, be, MN, CR) and pure elements (Fe, Zn). The main alloying elements in aluminum and aluminum alloys usually include silicon (si), copper (CU) and magnesium (Mg).

MATERIALS AND RESEARCH

Silicon (Si) effect: Silicon is the most important element of a single alloy used in most aluminum casting alloys. It is primarily added for "good fluidity" (high fluidity, low shrinkage), is a low density substance (2.34 g/cm³), which gives the advantage of reducing the total weight of the casting component, and dissolves very little in almost pure si aluminum, which improves hardness and edibility. Si reduces the coefficient of thermal expansion of Al-si alloys. When silicon is added to aluminum, the machinability deteriorates. Depending on the amount of Si concentration in its mass, Al-si alloy systems are divided into three large categories: pre-eutectic (<12% by weight), eutectic (12-13% by weight), post-eutectic (14-25% by weight).

G.T.Abdel-Jaber (Egypt) studied the silicon content (3-15% I) in Al-si alloys, as well as their hardness and mechanical properties compared to fusibility. The solidification time also increased with an increase in the si content, it was also

observed that the temperature of the liquid decreases to 12%, which corresponds to the percentage of silicon, while the tensile strength increases slightly with an increase in the silicon content from 3% to 8%. This is due to the eutectic composition and early pre-eutectic silicon. With an increase in the silicon content, the elongation gradually increases, reaching a maximum at which the si value was 12%. The minimum elongation is achieved with a mold thickness of 10 mm and a maximum mold thickness of 30 mm. This may be due to the influence of the degree of solidification. It was found that an increase in the silicon content leads to an increase in hardness. reaching the maximum value of hardness when the Si content in it is 12%, 70 MPa. Then the decline began, and Si became 60mpa at 15%. This is due to a change in the composition of the eutectic with an increase in the silicon content, as well as with the main silicon after eutectic. It was also found that the thickness of the mold does not have a clear effect on the hardness, and the full eutectic composition is only perfectly compacted and evenly distributed. The coefficient of friction and the rate of corrosion of cast Al-si alloys have also been studied, and it has been observed that weight loss decreases with an increase in silicon content up to 10%, and then increases slightly. A high weight loss was observed in the manufacture of a 10 mm thick mold, while in the manufacture of a 30 mm thick mold, a smaller weight loss was found due to the cooling effect and the presence of Al2Si solid particles.

Germanium (Ge) effect: Tajik researchers S.S.Gulov, I.N. Ganiev, A.E. Berdyev, R.X. Saidzoda,

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DJ.T. In the research work of the Ashurmatovs on the topic "The influence of Germanium and strontium on the mechanical, technological and structural state of the aluminum alloy of the AK9M2 brand", the change in its properties was analyzed when Germanium was included in the composition of the above-mentioned aluminum alloy. The conducted studies show that the introduction of Germanium into the alloy increased its fluidity to 30%, and the porosity at the inlet decreased to 10-12%. At the same time, the researchers included up to 0.1-0.3% (compared to the amount of charge) of Germanium in the composition of the alloy.

Cu effect of copper: Copper affects the hardness and strength of aluminum casting alloys both during heat treatment and untreated, as well as at high temperatures of outdoor and outdoor use. It also improves the workability of alloys by increasing the hardness of the matrix. On the other hand, copper usually reduces the corrosion resistance of aluminum and some alloys and alloys, increasing the corrosion susceptibility. S.G. Shabestari et al. (Iran) studied the influence of copper state and hardness on the microstructure and mechanical properties of Al-si-MG alloys. The researchers used a356 grade aluminum alloy with a copper content of 0.2 to 2.5% and cast various solid states (sand, graphite, copper and cast iron, iron molds). The highest tensile strength of the alloys was determined by heat treatment (T6), the degree of cooling of the mold (graphite), as well as with a copper content of up to 1.5%. The best mechanical properties were

manifested in graphite forms when AlSi dissolved in Mg alloy about 1.5% Cu.

Magnesium Mg effect: Magnesium (Mg) improves the hardening properties and strength of aluminum. The use of magnesium as an alloying element can lead to corrosion resistance and good weldability or to a very strong consistency. Silicon in combination with magnesium forms the Mg2Si phase, which provides high hardness and strength. Zhenggang Liu (China) investigated the effect of Mg on the dispersion of graphite particles in aluminum alloy matrix composites. At the same time, Mg was studied by adding as a surfactant to native aluminum to prevent clustering of graphite particles, as well as to improve the physical and mechanical properties of aluminum matrices. The results show that the Mg content in graphite increases with increasing. The correct amount of Mg additive is useful for hardening aluminum alloy matrix composites due to the mechanical properties of graphite particles, as well as for reducing materials and friction coefficient, which depend on the uniform distribution of solid particles.

The combined action of Mg (magnesium) and Si (silicon): Shubin Ren et al. (China) studied the effect of Mg and Si elements on the composition of aluminum in infiltrated SICP/Al composites with thermomechanical properties without pressure. Mg and Si additives can improve the wetting of aluminum with SIC aluminum. The results showed that with a Si content below 6% or Mg below 4%, the composites showed worse thermophysical properties, since the porosity of crude SICP/Al composites is lower due to the

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relative density of their composites. These composites are formed due to the low moisture permeability between Al and Si. An increase in the si content in an aluminum vessel leads to an increase in the modulus of elasticity, stability of thermal measurements and thermal conductivity of composites, and also reduces the coefficient of thermal expansion of composites. However, Si above 12% can reduce the thermal conductivity and bending strength of composites. The optimal amount of mg additives to aluminum is 4-8%, while the composites exhibit thermomechanical properties. However, as the Mg content increases by 8%, the high porosity of composites caused by low magnesium pressure leads to a decrease in thermomechanical properties.

Conclusion

From the above, it can be concluded that each element in an aluminum alloy has a different effect on its properties. Some elements serve to improve its casting properties, while others serve to improve its mechanical properties. Only what element is introduced in what quantity and in what condition becomes important in the soldering process.

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