The effect of the amount of lithium in aluminum lithium alloys on the property of fluidity

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Abstract. The fluidity property is one of the properties that occupies an important place in the process of casting alloys. The higher the fluidity property of metal and alloy, the better it fills the thin and thin areas of the mold when liquefied. The authors of the article researched the effect of the lithium fluoride compound on the fluidity property of aluminum alloy. Research has been carried out on aluminum brands AK7 and D16. Based on the experiments carried out, the researchers draw their conclusions at the end of the article.

1 Introduction

Nowadays, many parts of mechanical engineering are made of aluminum and its alloys. This, in turn, is the reason for the increasing demand for aluminum alloys in the world and various studies to improve their properties[1]. The studies on the mechanical properties of aluminum-lithium alloys have been made by Chinese scientists Wang Ya., Vru Ya., Liu M. The studies were conducted on the technology of obtaining a material with the necessary strength, forging and high elasticity, using alloying elements. At the same time, they proposed a method of rolling during the collection [2]. The work of the above-mentioned researchers shows that when a lithium element is applied to aluminum as a leaching element, its mechanical properties improve.

2 Materials and methods

In experiments, the lithium fluoride compound was added to the composition of the AK7 and D16 brand alloys of aluminum as alloying element [3-5]. Aluminum alloys of the AK7 and D16 brand are used for the manufacture of details by casting method. The samples were poured into a resistance furnace, which is widely used in foundry production.

The method of determining the fluidity property depends on the strength of the metal alloy, for example, the fluidity of steel, magnesium and alloys is determined by a rod sample obtained in a sand form. The cross-section of the fluidity of cast iron, bronze and aluminum

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alloys is trapezoidal, it is customary to determine it using a spiral sample, the model of which is shown in Figure 1 [6]. In the research work, the fluidity of the studied samples was determined using a spiral sample with a trapezoidal cross-section made of aluminum alloys.

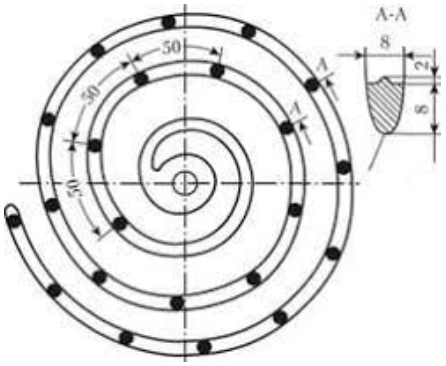

Fig. 1. Spiral sample drawing to determine fluidity.

Sand-clay molds were made for casting samples. The composition of the forms was prepared according to the standard. It consists of quartz sand, bentonite clay, water. Studies were conducted with the furnace setting at 750 °C.

3 Results and discussion

Samples were poured in resistance furnace in Foundry technologies Laboratory of Tashkent State Technical University. First, aluminum alloys were poured without the addition of a lithium-fluoride compound. The mass of each sample is obtained from 150 grams of homogeneous mass. The experiments were continued after casting the first samples without additives, while 5% to 15% lithium fluoride compounds were added to subsequent samples, depending on the weight of the charge. At the same time, lithium fluoride compound was added to the samples in the first 5%, 10%, 15% quantities [7-8]. The examples of studies of aluminum grade AK7 are shown on Fig. 2.

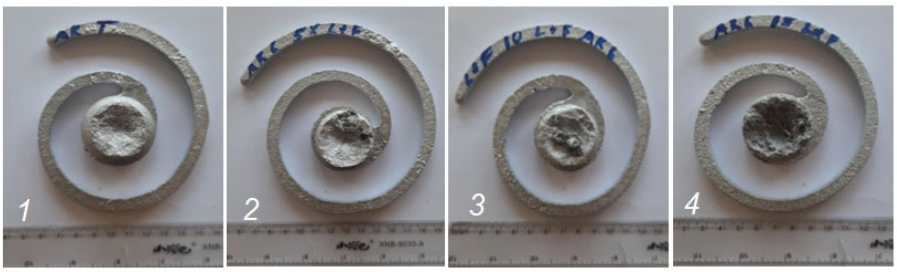

Fig. 2. Samples.1-AK7; 2- AK7+ lithium fluoride 5%; 3- AK7+ lithium fluoride 10%; 4- AK7+ lithium fluoride 15%.

At the next stage, the research was carried out on an aluminum alloy of the D16 brand [9]. At the same time, experiments are also carried out in the above order, that is, an aluminum alloy without additives was first cast. Then aluminum alloys with an impurity content from 5% to 15% were poured into spiral molds. [10]. Fig. 3 shows spiral samples cast from aluminum alloy, brand D16.

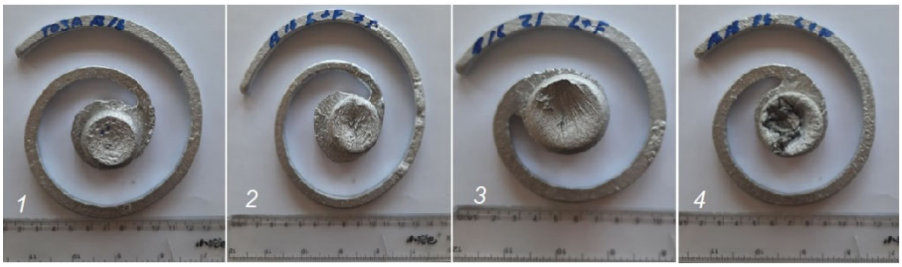

Fig. 3. Samples: 1-D16; 2- D16+ lithium fluoride 5%; 3- D16+ lithium fluoride 10%; 4- D16+ lithium fluoride 15%.

The results on the AK7 brand aluminum alloy showed that the length of the sample made of the AK7 alloy itself is 354 mm, when lithium compounds with fluoride are added to the alloy in an amount of 5% - 453 mm, when lithium compounds with fluoride are added to the alloy in an amount of 10% - 391 mm and when the composition of the lithium-fluoride compound alloy in an amount of 15% is 298 mm. made.

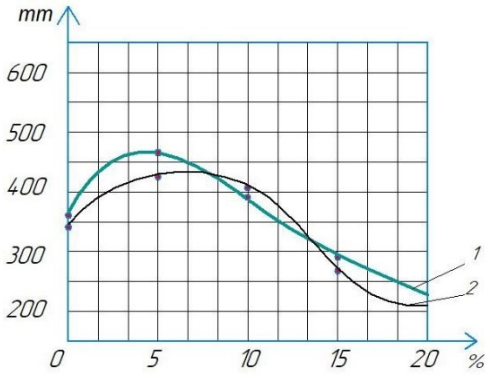

Fig. 4. The dependence of fluidity on the amount of lithium fluoride: 1 - AK7+ lithium fluoride; 2 - D16 + lithium fluoride.

The results of samples made of aluminum alloy of the D16 brand are as follows. The length of the sample cast from the D16 brand aluminum alloy is 341 mm, when lithium compounds with fluoride are added to the alloy in an amount of 5% - 434 mm, when lithium compounds with fluoride are added to the alloy in an amount of 10% - 404 mm and when the composition of the lithium-fluoride compound alloy in an amount of 15% is 273 mm. made. The experiments carried out by the authors showed that a graph of the dependence of the amount of lithium-fluoride on the flow properties of the aluminum alloy was developed. (Fig.4).

4 Conclusion

Studies have shown that the addition of a lithium-fluoride compound to an aluminum alloy significantly increases its fluidity. The best result showed a good effect from the introduction of lithium fluoride into the alloy in the range of 5% -10%. At the same time, it is recommended to add lithium fluoride in an amount of 5% -10% of the total weight. From the experiments and the developed graph, it can be seen that the introduction of lithium fluoride into the alloy made it possible to increase the fluidity of the AK7 aluminum alloy by 30-31%, and the D16 aluminum alloy by a maximum of 26-28%.

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