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THE EFFECT OF LITHIUM ON THE FLUIDITY OF NON-FERROUS ALLOYS

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Abstract

The article considers the effect of lithium fluorine compound on the fluidity property of aluminum alloy liquid. The experiments were carried out by adding lithium fluorine as alloying elements in the mass fraction. In this case, the lithium fluoride compound is included in the charge during the melting of aluminum in an amount from 5% to 15%. In the experiments, samples were taken using a resistance furnace. Based on the conducted experiments, a graph of the relationship was drawn up, on which the authors' conclusions were drawn.

Keywords: aluminum alloy, fluidity, lithium, fluorine, AK7, D16, furnace, temperature

1. Introduction

Currently, a lot of aluminum alloy parts are used in the world in the field of mechanical engineering. One of the pressing problems in aluminum alloys today is that the alloy does not have sufficient flow properties and is typical for gas pores in parts[1]. Aluminum alloy parts are made by liquefying aluminum by adding elements such as Si, Si, Mg, Zn, Mn, Ni, Fe, Ti individually or in a certain combination.Other similar additives to aluminum alloys, such as Ni, Cr, Sa, Na, Be, Ti, Ce, Nb, Li, are added in small quantities as elements that improve the properties of the alloy.These elements are physical, chemical and mechanical properties allow to obtain a wide range of aluminum alloys[2].Aluminum alloys are considered much

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more durable, but at the same time light.This has been added to the aluminum alloy as an element that leaches the lithium-fluorine compound in our research work to enhance its strength and casting properties[3].

2. Materials and Methods

Lithium fluoride compound is a binary chemical compound of lithium and fluorine and is a lithium salt of hydrofluoric acid. Under normal conditions-white powder or transparent colorless crystal, a non-hygroscopic, insoluble compound in cold water. It is a substance soluble in nitrate and hydrofluoric acids[4-5]. In the research work, a resistance furnace was used to obtain samples. (Fig. 1). The technical characteristics of the furnace are given in the table below (Table 1).

Table 1. Technical classification of the oven

1.	Capacity	1400 Vt
2.	Metal mass entering the crucible	3 kg
3.	Maximum temperature	1100 °C
4.	Dimensions of gabarite	485x700x950
5.	Current voltage	220 V

Figure 1.Resistance furnace

The samples were poured into sand-clay molds.The composition of sand-clay forms consists of: 85% quartz sand, 11% bentadine clay, 4% water.In this composition, a molding mixture was prepared and mixed in a mixer until the same mass was obtained.The finished mass was placed in pre-prepared flasks, and the molds for namana were pressed and prepared. Our experiments were carried out by setting the oven to 750 °C.

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3. Experments and Results

To compare the samples, first of all, an aluminum alloy of the AK7 brand was poured, without the addition of a lithium-fluoride compound. In order for the samples to be of the same mass, the charges were measured on a scale before crucifixion and loaded into an equal number of crucibles for the charge. Each sample was taken from 130 grams. In the next step, a lithium fluoride compound was added to aluminum alloy wrapped in aluminum foil. In this case, a lithium fluoride compound in the amount of 5% of the total mass was added to the first sample, 10% i was added to the second sample, and a lithium fluoride compound in the amount of 15% was added to the third sample[6]. To test the fluidity of non-ferrous metals in the first place for casting samples, a spiral sample (Curie sample) sand-clay molds were prepared [7-8] (fig.2).

Figure 2. The process of pouring sand-clay mixture into the sample.
a - casting process; b - spiral sample; s - cast sample.

The samples were separated from the molds after they were poured into the molds. Below are examples of studies of aluminum grade AK7 (Fig.3).

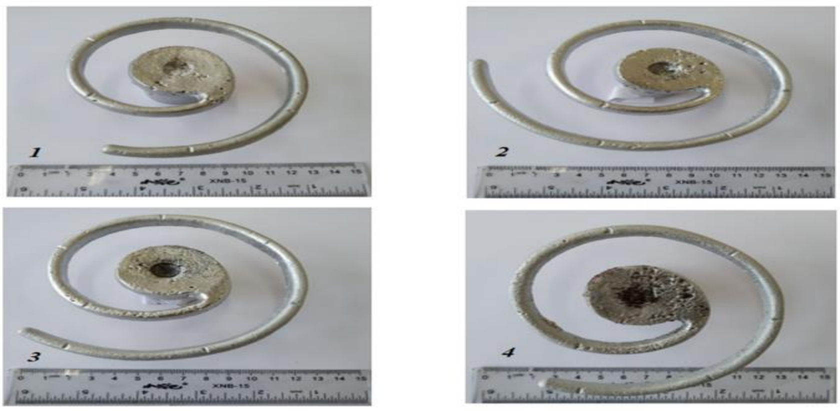

Figure 3. Cast samples. 1-AK 7; 2-lithium fluorine with the addition of 5% of the sample; 3-lithium fluorine with the addition of 10% of the sample; 4-lithium fluorine with the addition of 15% of the sample**.**

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The second stage of the experiment presented above was carried out. At the next stage, a lithium-fluorine compound was introduced into the D16 aluminum alloy. The experiments were carried out in the order given above. At this stage, experiments were carried out with a mass fraction of ham of 5%, 10% and 15%. The cast samples were separated from the molds and the length of the spiral of the samples was determined. The following are examples of studies on aluminum grade D16 (Fig.4)

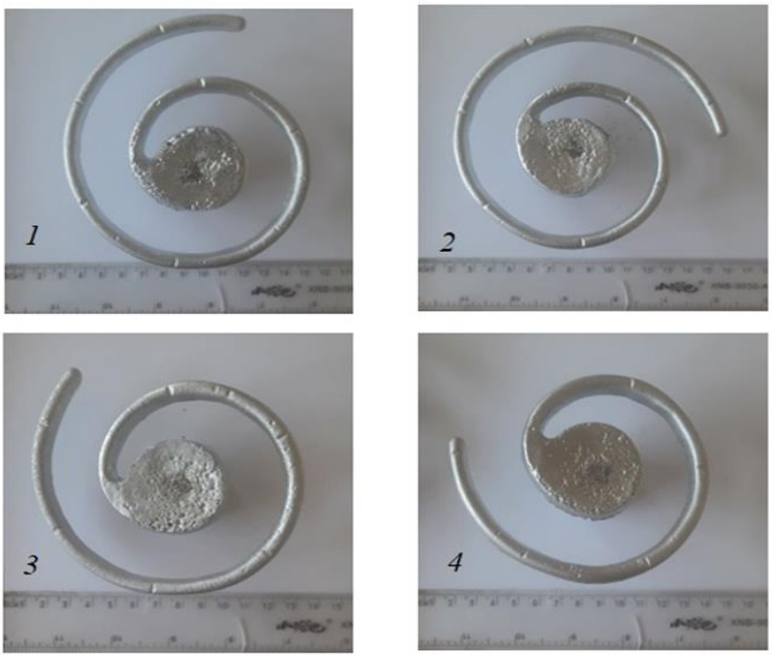

Figure 4. Cast samples. 1- D16; 2-lithium fluorine with the addition of 5% of the sample; 3-lithium fluorine with the addition of 10% of the sample; 4-lithium fluorine with the addition of 15% of the sample.

Measurement results for the AK7 brand: measurement results the length of the sample made of AK7 aluminum without the addition of lithium fluoride was 354 mm, the length of the sample with the addition of lithium fluoride 5% 463 mm, the length of the sample with the addition of lithium fluoride 10% 391 mm, the length of the sample with the addition of lithium fluoride 15% was 298 mm.

Measurement results for grade D16: measurement results the length of the sample made of grade D16 aluminum without the addition of lithium fluoride was 341 mm, the length of the sample with the addition of lithium fluoride 5% was 434 mm, the length of the sample with the addition of lithium fluoride 10% was 404 mm, the length of the sample with the addition of lithium fluoride 15% was 273 mm.

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Based on the measurement results, a graph of the dependence of the helical fluidity of the lithium fluorine compound was compiled. (Fig.5).

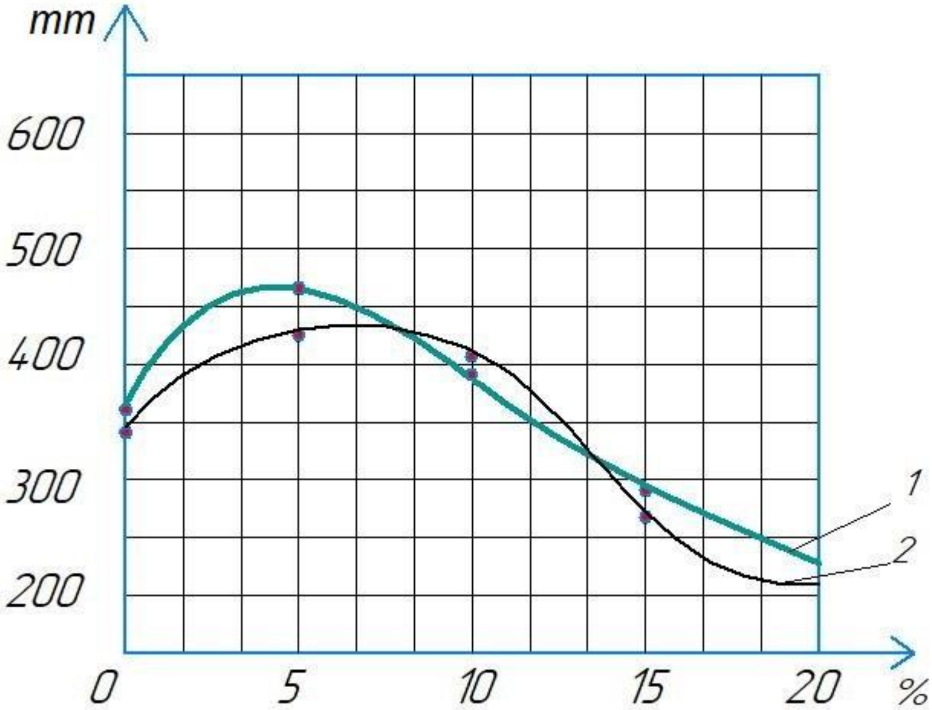

Figure 5. Graph of the dependence of fluidity on the amount of lithium fluorine. Line 1 is AK7; Line 2 is D16.

4. Conclusion

From the experiments carried out, it can be concluded that the yield strength increases to a certain extent compared to samples without the addition of lithium-fluoride compound added to aluminum alloys of the AK7 and D16 grades as a leaching element. In this case, it is recommended to add the most optimal amount of the additive in an amount of 4-5% I of the total mass. As you can see from the graph above, the best result is achieved by adding 4-5%. Fluorine casting allowed to increase the fluidity of AK7 grade aluminum alloy by a maximum of 30-31%, and the fluidity property of D16 grade aluminum alloy by a maximum of 26-28%.

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