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**DEVELOPMENT OF TECHNICAL SOLUTIONS TO REDUCE THE CONTENT
OF ALKALINE METALS IN ALUMINIUM ALLOYS OF 1XXX/5XXX/8XXX
SERIES**

AUTHOR'S ABSTRACT

of the thesis for

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The thesis has been performed at the Department of Metal-Forming Processes of the Institute of Non-ferrous Metals and Material Science of the Federal State Autonomous Educational Institution of Higher Education (FSAEI of HE), Siberian Federal University

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The abstract of the Master's Thesis is available on the website of the Siberian Federal University <http://edu.sfu-kras.ru/engineering> and in the open access archive:

<http://elib.sfu-kras.ru>

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INTRODUCTION

Timeliness of work. Aluminum consumption in the world is increasing every year. With the increase in consumption, the requirements to the quality of semi-finished products are constantly increasing: flat and cylindrical ingots, small-sized pigs and wire rods. One of the ways to improve the quality of aluminum alloys is to reduce the content of alkali metals of sodium and calcium leading to cracking edges during rolling. This factor increases the amount of technical waste generated by consumers, reduces the capacity to produce finished products. In order to improve the quality of aluminum alloys and preserve consumers, it is necessary to develop technical solutions that will reduce the content of sodium and calcium in aluminum alloys without reducing the production capacity for the production of finished products.

The subject of the study - Technology of production of slab of aluminum alloys 1XXX/5XXX/8XXX.

Work objective – Applied materials and equipment in the technological cycle of aluminum alloy production³

The following tasks are being accomplished to achieve **the objectives**:

- Analyze the content of sodium and calcium in the technological cycle of production of aluminum alloys from the electrolyzer to the finished product.
- Analyze the effect of the alloying materials used.
- Analyze the effect of the equipment used and its regimes for melt refining.
- Carry out an analysis of the methods and methods used in the world practice to reduce the content of alkali metals in aluminum alloys.
- To develop technical solutions that allow more efficient refining of aluminum melt from alkali metals as compared with commercially available ones.
- To work out the technology of production of aluminum alloys using the developed technical solutions for more effective refining.
- To produce pilot lots of aluminum alloys in the form of flat ingots in order to confirm the achieved results.
- Analyze the results.

Scientific novelty of work

The developed technical solutions allow to reduce the content of sodium and calcium in aluminum alloys.

Practical relevance of the research

- The new design of the impeller of the SNIF rotor of the SNIF unit allows more efficient refining of the aluminum melt during the casting process.
- The developed technical solutions do not reduce the production capacity for the production of aluminum alloys.
- Application of the developed technical allowed to expand the use of aluminum alloys with a low content of alkali metals.

Personal contribution of the author

All results of the research were obtained with the personal participation of the author.

Place of accomplishment of the thesis. Department of Casting Process of the

Institute of Non-ferrous metals and Material Science of the Federal State Autonomous Educational Institution of Higher Education (FSAEI of HE), Siberian Federal University.

Place of international internship. MECAS ESI Group, the Czech Republic.

Approbation of the thesis The main provisions of the thesis are not presented in the media in conformity with the confidential policy of UC RUSAL.

Publication. N/A.

The volume and structure of the thesis. The thesis consists of an introduction, two chapters and a conclusion. It contains 154 pages of text, 63 figures, 18 tables, reference list of 43 positions.

CONTENT OF THE THESIS

Urgency of the research The relevance of the topic is substantiated and the goal, tasks of the work is formulated, its novelty and practical significance is noted.

In the first chapter The characteristic features of alkali metals, flux materials, equipment for refining aluminum melt are considered.

The analysis of scientific and technical literature made it possible to draw the following conclusions.

1. Aluminum alloys in the form of flat ingots are widely used for the production of aluminum products of aircraft building, machine building, shipbuilding industries, consumer goods.
2. Existing equipment for cleaning the melt from alkali metals requires large capital investments.
3. There are many flux materials for cleaning from alkali metals.

Based on the conclusions drawn, the tasks of the dissertation work are formulated.

The second chapter the analysis of the sodium and calcium content in the current scheme for the production of finished products from aluminum alloys of UC RUSAL from the electrolyzer to the finished product is performed. A comparative evaluation of the effectiveness of existing refining regimes using serial parameters, materials and proposed on the basis of the literature review and technical characteristics of the equipment was performed. Modeling of the rotor impeller design of the SNIF unit responsible for the distribution of chlorine in the aluminum melt is performed. Selection of refining flux materials for metal processing in a mixer has been carried out, parameters of melt refining in a mixer and casting process have been developed. The experimental batches of products were made, the chemical composition of the selected samples was analyzed in the technological cycle of preparation and casting of aluminum melts from the mixer to the finished product. Delivery and processing of experimental lots of aluminum alloys in the form of flat ingots to consumers is carried out. A positive conclusion has been obtained on the content of alkali metals (Na not more than 0.5 ppm, Ca not more than 0.5 ppm) and the absence of edge cracks during rolling.

The **conclusion** presents the main findings and results of the research.

MAIN FINDINGS AND CONCLUSIONS

- The analysis of sodium and calcium content in the technological cycle of production of flat ingots from the electrolyzer to the finished product is performed.
- The effect of the alloying materials used is analyzed.
- The effect of the equipment and its regimes for melt refining is analyzed.
- The analysis of applied methods and techniques in the world practice on the reduction of the content of alkali metals in aluminum alloys is performed.
- Technical solutions have been developed that allow more efficient refining of aluminum melt from alkali metals in comparison with the standard ones.
- The technology of production of aluminum alloys in the form of flat ingots has been worked out using the developed technical solutions for cleaning aluminum melt from alkali metals.
- Experimental batches of aluminum alloys in the form of flat ingots with the content of alkali metals (Na not more than 0.5 ppm, Ca not more than 0.5 ppm) are produced.
- The regulatory and technological documentation for the mass production of finished products with requirements for the content of alkali metals (Na not more than 0.5 ppm, Ca 0.5 ppm or less) has been developed.

CONCLUSION

The goal and objectives of the master's dissertational work are fulfilled in full. The results of studies of the chemical composition confirm the achievement of the content of alkali metals in aluminum alloys 1XXX / 5XXX / 8XXX series (Na not more than 0.5 ppm, Ca no more than 0.5 ppm). Publications on the work performed were not released due to the confidential policy of UC RUSAL.