

Mikhail Vasilyevich Omelyanenko

**DEVELOPMENT OF TECHNICAL SOLUTIONS FOR THE REDUCTION OF
HYDROGEN IN CASTING ALLOYS AND SLABS OF THE 6XXX SERIES**

AUTHOR'S ABSTRACT

of the thesis for

Master of Science Degree in the field of Metallurgy (22.04.02)

Master's program - "Process control in casting technologies" 22.04.02.08

Krasnoyarsk 2017

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

Thesis Tutor:

Cand. Sc. Eng., Associate Professor Irina Vladimirovna Dubova

Reviewer:

Aleksandr Vladimirovich Proshkin, Head of the Laboratory of Carbonaceous and Lining Materials, RUSAL ETC LLC

The thesis defence will take place on June 27, 2014, at 10:00 at the FSAEI of HE Siberian Federal University, at the following address:

Lecture hall 348, 95 Krasnoyarsky Rabochy Prospekt, Krasnoyarsk, 660025

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>

Tutor of the Master's program:

Cand. Sc. Eng.
Associate Professor

V.N. Baranov

INTRODUCTION

Timeliness of work. To date, simultaneously with the growth of world consumption of aluminium is constantly increasing requirements to quality of aluminum alloys. Consumers increase demands on chemical composition of the alloys, macrostructure, the content of gaseous contaminants, primarily hydrogen. In this regard, it is necessary to develop technical solutions that will allow to produce commercial products that meet consumers' requirements, regardless of the nomenclature, and, thus, to maintain production capacity of the aluminum plant.

The subject of the study is the technology for the production of slabs of aluminium alloys as well as materials and equipment used.

Work objective: To develop technical solutions reducing the content of hydrogen in slabs of 6XXX series.

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

- to provide a theoretical overview of the existing methods of decontamination of aluminum alloys
- to develop technical solutions to ensure that the hydrogen content in the products is not more than 0.10 cm³/100 g in casting alloys and slabs of the 6XXX series;
- to optimize production parameters and release pilot batches to confirm the achievements.

Scientific novelty of work

1. The identified dynamics and the theoretical explanation of the change of hydrogen content in the technological chain of production of marketable products.

Practical relevance of the research

1. A new design of molds for sampling, providing accurate data on hydrogen content in commercial products.
2. Products manufactured with use of the technical solutions developed will increase their volume of consumption.
3. The technical solutions developed do not reduce the production capacity of the goods.
4. Increased sales of low-hydrogen products.

Personal contribution of the author

All the results of the research have been obtained with the personal participation of the author, the main ones being: selection of a new design of the mold for hydrogen content detection sampling; the parameters of refining of liquid-alloy during the casting process.

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 Professional Education (FSAEI of HPE), 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 _ pages of text, _ figures, _ tables, reference list of _ positions and _ appendices.

CONTENT OF THE THESIS

Urgency of the research is well-grounded, the purpose of the work is formulated, and its novelty and practical significance are mentioned in the introduction.

The characteristic features of aluminium of commercial purity are considered in the **first chapter**. given industry for which use flat bars. Pro-analyzed the equipment used, the materials with which are made of flat bars. The influence of hydrogen content on the quality of the product. The existing methods of decontamination and methods for determination of hydrogen content. It is concluded that the existing methods of decontamination do not achieve the desired purity. It is concluded that the molds do not provide the desired quality of the samples for the determination of hydrogen content.

The **second chapter** made the selection of parameters of degassing of the melt, providing a low content of hydrogen in the melt. Selection molds for sampling, providing accurate data on hydrogen content in commercial products. The analysis of dynamics of changes of hydrogen content in the technological chain of production of marketable products. Made an experimental batch of commercial products. Worked out options for mass production of foundry alloys and billets 6xxx series.

The **conclusion** presents the main findings of the work.

MAIN FINDINGS AND CONCLUSIONS

1. Selected chill new designs for sampling on the hydrogen content.
2. Performed testing of parameters in the production of casting alloys and billets 6xxx series on industrial equipment with the requirements for the hydrogen content in commercial products.
3. The analysis of dynamics of changes of hydrogen content in the technological chain of production of marketable products.
4. Technical solutions do not reduce the production capacity for finished products.
5. Increased demand for cast alloys, and flat bars 6xxx series with low hydrogen content.
6. Developed technical solutions allow to mass-produce cast alloys and flat bars 6xxx series with the required hydrogen content.

