

**The review of the dissertation Padamata S. K. «Electrolysis of cryolite-alumina melts and suspensions with oxygen evolving electrodes», submitted for the degree PhD SibFu**

Since the creation of the technology for producing aluminum in 1886, which is currently being used, the search for ways to change the composition of the electrolyte, the materials of the anodes and cathode down conductors, and the design of electrolyzers does not stop. This work is devoted to the study of the possibility of producing aluminum by electrolysis of low-temperature fluoride-alumina melts using an inert anode, a tungsten cathode, and alumina suspensions in fluoride melts.

In particular the present PhD thesis focuses on the following laboratory tests:

1. Anode behaviour of aluminium bronze electrodes and cathode behaviour of tungsten electrode at polarization in  $\text{KF-AlF}_3\text{-Al}_2\text{O}_3$  melts.

2. Aluminium oxide dissolution kinetics in  $\text{KF-AlF}_3\text{-Al}_2\text{O}_3$  melts. The studies were conducted in wide parameters such as varying temperatures, the volume fraction of alumina and cryolite ratios.

3. The behavior of alumina particles in its suspensions, in particular, the rate of their sedimentation.

4. Electrolysis of  $\text{KF-AlF}_3\text{-Al}_2\text{O}_3$  melts was conducted using Cu-10Al anode and tungsten cathode in the cells with vertical electrodes.

The work undoubtedly contributes to the understanding of the processes occurring at the inert anode and tungsten cathode during the electrolysis of molten salts, and also sheds light on the behavior of alumina suspensions in melts. The present work also is highly significant when it comes to greenhouse gases free aluminium production. The information from this dissertation is a useful contribution to the inert anode development.

The quality of the material is of international standards and it can be justified through the candidate's publications (5 articles) in reputed journals.

Contemporary techniques were used for the investigation. The PhD candidate has used state-of-the-art equipment. All methods used by the candidate are appropriate to his research theme.

The use of modern equipment and various modern analysis methods in the work proves the reliability of the results obtained in the work. The results also are well justified and no significant flaws were found.

The dissertation structure is constructive and complete.

The candidate showcases good knowledge in the literature provided. It can be seen from the literature review and discussion chapters. All the references used are relevant to the topic and well used.

As the dissertation contains the information related to the inert anode development, alumina dissolution and production of aluminium by electrolysis, the results obtained by the author will undoubtedly be useful in the development of technology for the electrolytic production of aluminum in electrolytic cells with inert anode and in electrolytic cells with vertical electrodes when using alumina suspensions as an electrolyte.

The author himself conducted experiments on the study of behavior of metallic anodes in melts and suspensions at various parameters and directly involved in the discussion of the results. It should be noted that the results achieved in the dissertation fill the gap in inert anode development.

The language of thesis is of good quality and is precise.

When reading the thesis, some questions and comments appeared.

1. Why, although the author did examine the anode behaviour of aluminium bronze electrode in melts and suspensions, the final electrolysis test was only conducted in melts ( $CR = 1.4$ ) and not in suspensions. It would be interesting to know the current efficiency, cell potential and aluminium purity while performing electrolysis in alumina suspension melts.

2. On some charts there is a considerable scatter in the data, although the meaning of graphics have to be a smooth curve. It is clear that the scatter is due to experimental errors. The question arises why the author did not process such data and did not receive a trend line.

3. It should be noted that in the dissertation there are clerical errors, in some cases incorrect figures are given.

Despite questions and comments in general, the results presented in the dissertation are very interesting and will be useful for the aluminum industry. Padamata S. K. deserves to be awarded to him the degree PhD SibFu.

**Name of the Dissertation Commission Member : Mikhalev Yu. G.**



**Chair / Function : Professor**

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