



To the dissertation council 6D.KOA-042 at the
Institute of Chemistry named after V.I. Nikitin of the NANT
and the Agency for CBRY Security of the NANT

Hunan University of Technology, 25 November 2024

Review

of the abstract of the dissertation work of Rahimzoda Hayot Shifokul on the topic: "Development of an effective technology for the production of antimony from antimony-sulfide concentrates", submitted for defense for the degree of candidate of technical sciences in the specialty 05.17.00 - Chemical technology (05.17.01 - Technology of inorganic substances).

Securing abundant supply of critical raw materials is challenging and this has received wide attention of both the developed and developing nations. Attention is being given not only because of their need for economic production but also for their use in emerging technologies. Antimony (Sb) is one such metal of interest that has wide applications in the modern industrialized societies. In 2018, the United States (US) government classified Sb as a critical raw material (CRM). From 2016 to 2019, China was the main import source to the US by providing 46% of unwrought Sb metal and powder and 63% of its total metals and oxides. Furthermore, European Commission (EC) has classified Sb as a CRM based on its supply risk and economic importance in 2011, 2014, 2017, and 2020, successively. The European Union (EU) is heavily dependent on imports (100%) for primary source of Sb. This huge dependence is due to the lack of primary Sb ores in Europe. Tajikistan ranks third in the world in antimony mining. Of the total volume of 110,000 tons, Tajikistan accounts for 13,000 tons. Both hydrometallurgical and pyrometallurgical processes pose environmental challenges. Hydrometallurgy

generates liquid waste that requires careful management to prevent contamination. Pyrometallurgy, on the other hand, produces gaseous emissions such as sulfur dioxide (SO₂) and carbon dioxide (CO₂). They are energy-intensive due to the high temperatures required for smelting and refining. Optimizing energy use and exploring alternative energy sources, such as renewable energy, can reduce the carbon footprint of antimony recovery operations.

Therefore, the introduction of innovative technologies in the conditions of the Republic of Tajikistan for the production and processing of metallic antimony from local raw materials is a relevant and effective topic.

The proposed technology of the scientific dissertation of Radhimzoda Hayot Shifokul is beneficial both from the point of view of ecology and from the point of view of economy. Because it provides a low temperature of the pyrometallurgical process. Date 10/17/2023. to 10/24/23. An international conference on the topic "Research and application of low-carbon metallurgy and the search for new production methods using green energy" was held at the South-Central University of the People's Republic of China with the participation of world scientists. Rahimzoda H.Sh. spoke on this topic and the proposed work was well received by scientists.

The following comments are made regarding the abstract:

1. Why were sodium and calcium chlorides used as reactants in the combustion process? Did you use iron chloride?

Conclusion

The dissertation work of Rahimzoda Kh.Sh. on the topic: "Development of an effective technology for the production of antimony from antimony-sulfide concentrates" is a completed research work. The author's publications fully reflect the content of the dissertation, which are published in leading scientific journals peer-reviewed by the Higher Attestation Commission of the Republic of Tajikistan and other countries. Based on the research results, new scientific data were obtained on the mechanisms of interaction of components of the studied complex systems, recommendations were given for the practical use of the results obtained. This study makes a significant contribution to the chemistry and technology of

antimony production. The author of the dissertation work Rahimzoda Kh.Sh. deserves to be awarded the sought-after degree of candidate of technical sciences in the specialty 05.17.00 - Chemical technology (05.17.01 - Technology of inorganic substances).

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