Dissertation review report of A.A. Ashimova

titled “Study of harmony preservation in subsoil development through waste processing”, submitted for the degree of Doctor of Philosophy (PhD), educational program 8D07203 “Mining Engineering”

The dissertation by Ainash Adilhankyzy Ashimova addresses a highly relevant problem at the intersection of mining engineering, environmental safety, and materials science: achieving harmony in subsoil use through the valorization of industrial waste as construction materials. The work focuses on recycling thermal power plant ash and slag, as well as mineral processing waste, and on their effective application in shotcrete, binders, and aerated concretes for mining and civil engineering purposes. The topic is timely and aligned with current industry priorities in circular economy and sustainable resource management.

All core theses, conclusions, and recommendations are well substantiated and demonstrate scientific novelty. The author proposes optimal compositions of fly-ash-based binders and aerated concrete (target density 700-900 kg/m^3) and develops shotcrete mixtures for stabilizing quarry slopes and underground workings at the Akzhal deposit. The results provide practical technological solutions that contribute to safer and more environmentally responsible mining operations and to the production of efficient, eco-friendly building materials.

The research is methodically sound and conducted in accordance with applicable regulations, including the relevant GOST standards of the Republic of Kazakhstan. The dissertation demonstrates a high level of independence, logical structure, and consistency of argument. A comprehensive analysis of the chemical and phase composition of mining waste (tailings, aggregates, and process water) is presented. Conditions and admissible limits for their use as secondary raw materials in construction are established, which reinforces both the novelty and the practical value of the study.

The author develops and experimentally validates:

– efficient shotcrete mixtures for stabilizing quarry slopes and underground mine workings at the Akzhal deposit, showing improved stability of benches and effective crack remediation;

– ash- and slag-based binders and non-autoclaved aerated concrete produced from thermal power plant waste, achieving the stated density range and performance targets.

The findings have been presented and discussed at reputable venues, including the International Scientific and Practical Conferences of Kazakh National Research

Technical University named after K.I. Satbayev (2022, 2024), the 18th International Congress for Mine Surveying (Xuzhou, China, 2023), and the International Forum of Mine Surveyors “Geospatial Digital Engineering in Geodesy, Mine Surveying, and Geomechanics” (Karaganda, 2023). This dissemination confirms the visibility and external validation of the results.

The practical significance is clear: elements of the research have been implemented in production activities and integrated into educational processes. The results are protected by the following titles of protection of the Republic of Kazakhstan: utility model – “Method for producing ash-containing binder”; utility model – “Composition of non-autoclaved ash-gas concrete and the method for producing it”; and certificate – “Assessment of suitability of enrichment waste for the purpose of creating solutions for strengthening fractured slopes.”

These outcomes provide a strong basis for future inclusion in regulatory and guidance documents.

The dissertation by Ashimova Ainash Adilhankyzy is a complete, rigorous, and original research work that fully addresses its objectives. It meets standards of credibility and academic integrity, has both theoretical and practical significance, and complies with the Regulations on the Procedure for Awarding Academic Degrees of the Republic of Kazakhstan. I recommend the dissertation Study of harmony preservation in subsoil development through waste processing for defense for the award of the degree of Doctor of Philosophy (PhD) in the educational program 8D07203 “Mining Engineering.”

The author Ashimova Ainash Adilhankyzy merits the conferral of the PhD degree in the educational program 8D07203 «Mining Engineering».

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