

Section 03. Challenges in Environmental Protection

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Technologies of Valuable Components Recovery from Coal Mine Waste Heaps

Waste heaps are an integral part of the technological cycle of underground coal mining formed by rock winding to the surface after a complex of mine workings development. Dumps are not only a source of environmental pollution, condemnation of valuable land and deterioration of human health, but also a "technogenic deposit" of useful components on the earth's surface, despite the fact that they are classified as dumps. Analysis of valuable components in rock dumps allows to determine possible technologies for their recovery.

Most easily recovered component of the rock dump is coal fractions, the content of which varies from 10 to 40%. To separate coal from waste rock, a method of gravity separation applying heavy hydraulic media consisting of various components (trichloroethane, dibromoethane, etc.) was widely used to give it different densities. As a result, different particles of mined rock sink to different depths, rock particles are deposited, as they are heavier, and lighter coal fractions are distributed in the upper part. A significant content of iron oxide (up to 20%) in the dumps can be extracted by electrostatic separation based on the ability of various metals to accept charge. The crushed rock mass enters the electromagnetic field, the metal components are magnetized and separated from the nonmagnetic ones. In addition, this method can produce valuable rare-earth metals (germanium, scandium, gallium, etc.). The total content of these elements is estimated at least 200 g / t.

In Western countries the bioleaching method is intensively developed. It uses microorganisms as catalysts or special agents of biochemical destruction processes or dissolution of mineral compounds. This method is characterized by simplicity, low price and environmental safety. This method can also be used for rare-earth metals extraction. Rock dumps have very high content of alum slate (aluminum raw materials) within 10-25%. There is a problem of processing this raw material because of the presence of a significant content of silica and thus the lack of universal technologies. Nevertheless, there is a method of sintering (acid method), based on the treatment with two kinds of acids. Aluminum sulfate is obtained as a result of a number of processes - preparation, initial processing, sintering, purification and calcination. In such a way, using a combination of technologies for extracting valuable components in places with more dense dumps location will allow the creation of processing enterprises. In addition, it requires serious study of technical and economic feasibility, analysis of market environment and encouraging the investment support for such projects.