

RESEARCH ON THE APPLICATION OF PASTE BACKFILL MINING TECHNOLOGY AT UNDERGROUND COAL MINES IN QUANGNINH COALFIELD

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The extraction of coal seams lying under the areas that need surface protection in Quangninh coalfield is crucial and practically significant in current period in Vietnam. In backfill mining technologies, paste backfill is the best choice for the conditions of Vietnam's underground coal mines to recover the maximal non-recycle resources, minimizing the effects of underground mining on the surface subsidence and increasing the efficiency of mining operation. For paste backfill mining technology, choosing the appropriate backfill material is so important. The research in the laboratory and numerical modelling regarding select proper materials and material ratios of fly ash, bottom ash, cement, water to use in paste backfill mining technology were conducted from 2019 to 2021 in Institute of Mining Science and Technology (IMSAT). By using the testing samples can identify physical properties and the properties suitable for paste backfill technology such as mechanical strength test; the possibility of flushing, swelling; carrying capacity hydraulic...

Source of backfill material from thermal power plant in Quangninh region



Fig 1. Fly ash



Fig 2. Bottom ash

From December 2019 ÷ June 2020, IMSAT coordinated with chinese experts to conduct the experiment to determine the properties of materials from available waste ash of Cam Pha thermal power plant, including: Physical and mechanical properties (density, volumetric mass, porosity and moisture); Chemical composition; Particle size composition of the backfill material; Optimal backfill material distribution ratio (figures 1,2,3,4 and table 1).



Fig 3. Material slump testing



Fig 4. Compression test

Table 1. TEST RESULTS TO DETERMINE BACKFILL MATERIAL PROPERTIES

No.	Experiments to determine the properties of backfill materials	Sample	Fly ash	Bottom ash
1	Specific weight, g/cm^3	10 samples of fly ash, 10 samples of bottom ash	2,580	2,639
2	Volume mass and porosity, g/cm^3	10 samples of fly ash, 10 samples of bottom ash	0,572	1,551
3	Humidity, %	10 samples of fly ash, 10 samples of bottom ash	-	0,402
4	Diameter of material particles, mm	10 samples of fly ash, 10 samples of bottom ash	$0,005 \div 0,069$	$0,25 \div 10$
5	Chemical composition	10 samples of fly ash, 10 samples of bottom ash	$SiO_2, Al_2O_3, Fe_2O_3, CaO, KO$	$SiO_2, Al_2O_3, Fe_2O_3, CaO, KO$
6	Slump of mortar backfill material, mm	10 samples of fly ash, 10 samples of bottom ash	220 ÷ 250 with mortar concentration (bottom ash+fly ash+cement+water) 77,3%	
7	Uniaxial compressive strength of mortar sample block, MPa	10 samples of fly ash, 10 samples of bottom ash	2,57 ÷ 11,5 with mortar concentration (bottom ash+fly ash+cement+water) 77,3%	
8	Pipeline transportation	10 samples of fly ash, 10 samples of bottom ash	The optimal ratio of bottom ash: fly ash: cement: water is 11,6 : 4,5 : 1 : 5	

The backfill material is transported by car from the nearby Cam Pha thermal power plant to the mixing plant on the site level +30 of Quang Hanh coalmine. Here, fly ash, bottom ash, cement and water are mixed in proportions as shown in table 1. Then, the backfill material mixture is pumped down the pipeline to supply longwalls below (figure 5).

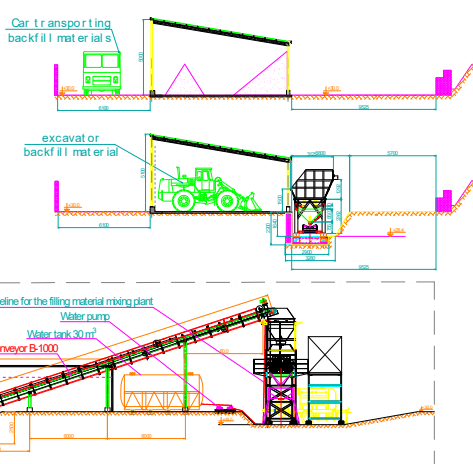


Fig 5. System diagram for providing backfill material on the site

Research results show that advantages of paste backfill mining technology are highly synchronized mechanization; Available materials, low cost; small shrinkage (2 ÷ 5%), good surface protection effect. Paste backfill mining technology is a new technology for the Vietnamese mining industry. In the initial phase, IMSAT coordinated with Chinese experts to research and determine the optimal distribution of backfill materials from the available waste ash of Cam Pha thermal power plant. In addition, prepare construction design applying paste backfill mining technology for longwall TT-6-4 of Quang Hanh Coal Company (backfill material supply system on the site; pipeline transportation system; process technology, safe technical measures for backfill mining longwall; surface subsidence monitoring system, etc.). This is the basis for practical implementation in the upcoming time.