

USING LOCAL MATERIALS AND SOLID WASTE FOR SPECIAL MINE-FILL CEMENT PRODUCTION

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ABSTRACT Shifted rocks, ore tailings ash and other solid waste are placed on earth's surface near mines and opencasts are a source of environment pollution. When exploiting thick ore deposits by filling system it is necessary to use fill materials and industrial cement. High quality industrial cement for building constructions is expensive. There are other requirements for filling mass, compression strength, reliability and lasting. That is why it is necessary to produce special fill cements of low quality and low price by the use of local materials and solid waste. The review of such production is presented on the basis of the results of laboratory tests and experimental outputs from some regions of Republic of Kazakhstan.

Republic of Kazakhstan is a country with high-level development of mining and metallurgical industries. It is a cause of big volume accumulation of solid waste such as shifted rock- ore tailings and metallurgical slag which are placed on earth's surface near mines and opencasts and are sources of environment pollution. The level of their utilization in Kazakhstan now is low.

When exploiting thick ore deposits by room-and-pillar or other methods with consolidating stowing it is necessary to have fill materials and binding components. In mining practice there is an experience of using solid waste as aggregate of filling mixtures. It is proved that ore tailings are good components for hardening filling mixtures (Balakh 1977, Tsygalov 1985). As a binding material now as a rule industrial cement is used. It is too high quality to meet the requirements of State All Union Standards for civil engineering and expensive. It is known that requirements for filling mass compression strength, reliability and lasting differ from requirements for building constructions because they are formed in different conditions and are used for different purposes. For example average compression strength necessary for filling mass at Kazakhstan mines exploiting thick ore deposits is not more than 5 MPa (curing time - 28 days). That is why it is necessary to produce special fill cements of lower quality and low price by using local materials and solid waste. Our investigations were carried out for

different regions of Kazakhstan with the purpose of selection of optimal proportion of components for cement production and good results were received. Therefore, the use of mineral raw materials of Zhezkazgan region for making cement from local materials and solid waste was investigated. It is shown that when Zhezkazgan ore tailings are calcined together with Aktas deposit limestone in a rotary kiln at a temperature of 1400-1450°C we may receive not high active cement clinker (the content of its most active component is only 37-38% whereas in industrial cement it is 50-60%). Filling mixtures including a mixture of cement clinker (30-35%) and fine aggregate (ore tailings) (65-70%) with a compression strength of 3-4 MPa (curing time of 28 days) were obtained. It fulfils the specifications required by the technological applications and may be used in practice.

It is proved that the use of Zhezkazgan impoverished slag (from Zhezkazgan copper plant) in process of mixture calcination may increase cement clinker quality. By calcining the mixture containing 68-70% of Aktas limestone, 7-8% of Zhezkazgan ore tailings and 21-22% of Zhezkazgan impoverished slag cement clinker of high quality (active content is more than 60%) was produced. If the compressive strength of cement produced in this manner reaches 40 MPa (curing time of 28 days) it may be classified as quickly hardening cement. Its consumption of ISO 200 kg per 1 m³ of filling mixture ensures

attainment of compression strength corresponding to the requirements of technology for the compression strength of filling mass and may also be used in practice

It is necessary for Zhezkazgan mining-and-metallurgical complex to purchase about 240 thousand tons of industrial cement a year for filling operations. Design-basis cement output of aforementioned cement is about 100 thousand tons a year. This production ensures to utilize 10-11 thousand tons of ore tailings and 34-35 thousand tons of impoverished slag a year. Cement consumption per 1 m³ of filling mixture may be decreased to 60-100 kg. Besides this, 1300-1350 thousand tons of ore tailings a year will be used as fine aggregate. Economical estimation showed that high-quality cement production from local materials and solid waste is more profitable in comparison with low-quality cement production because it gives a possibility to reduce industrial cement consumption by 1.8 times and to make considerable economical profit.

Good results were obtained from laboratory testing of mixtures including local natural material (red clay of Akzhal deposit) and solid waste (Akzhal ore tailings from gravity separation and flotation and also Zhambul pyrites) of JSC "Kaztungsten" region. Five compositions were tested; clay - 3-18%; ore tailings from gravity separation - 13-83%; ore tailings from flotation - 46-86%, pyrites - 0.4-5.2%. By calcining these mixtures in a rotary kiln at a temperature of 1420±20°C it is possible to produce cement clinker with compression strength of 61-62 MPa (curing time - 28 days) on the basis of which is equivalent to Portland cement of M 400 type and may be used both for filling operations and civil-engineering.

CONCLUSIONS

Laboratory and industrial testing showed that it is possible to make high quality cement for filling operations and also for civil-engineering from natural local materials (different kinds of clay ore limestone) and solid waste (ore tailings, metallurgical slag, pyrites and so on). It allows to decrease consumption of industrial cement. New sorts of cement production by using solid waste is profitable and allows to decrease harmful attack to environment in mining regions of Republic of Kazakhstan.

REFERENCES

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