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Attempt at Estimation of Gangue Slimes Quantity Carried over with Collector Droplets in Flotation of Some Polish Coals

Próba oszacowania ilości szlamów skały płonej, wynoszących z kropelkami kolektora podczas flotacji niektórych węgli polskich

Испытание оценки количества шламов пустой породы извлекаемой каплями коллектора во время флотаций некоторых углей Польши

In mining, transport and processing of coals a considerable quantity of slurry containing coal grains and gangue slimes is formed. Coal from the slurry is usually recovered by flotation and then used as a raw material in metallurgy. The quality of coal — from the point of view of metallurgy — is determined by ash content in it. As the presence of gangue in flotation concentrate enhances the ash content, it is obvious that the selectivity of flotation enrichment is a problem of primary importance. The problem may be worked out by investigation of each of the elementary flotation processes.

One of the ways in which the gangue slime can be carried over into flotation concentrate is the transport of slime particles in the water layer attached to nonpolar collector droplet moving in water solution [1, 2]. The aim of this investigation is to determine the quantity of gangue slimes transported in this way into the flotation concentrate.

EXPERIMENTAL PART

200 ml of water suspension of slime gangue containing flotation reagents of selected concentration were shaken for 15 minutes in a funnel. The density of suspension was 50 grams of solid per liter, because flo-

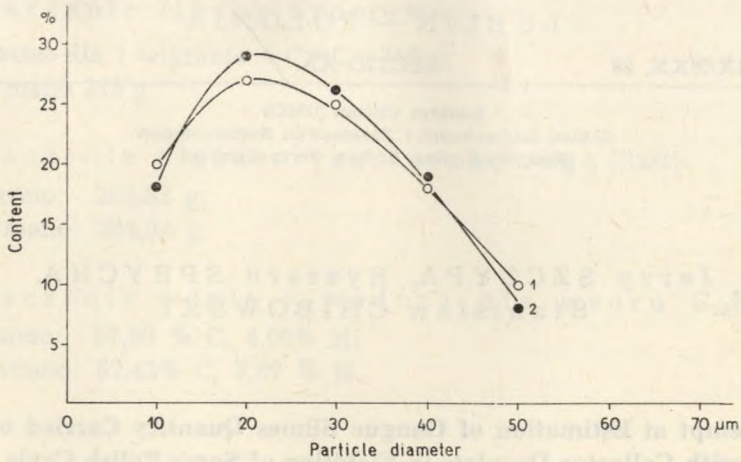

Fig. 1. Results of granulometric analysis: 1 — gangue slimes from coal mine "Anna", 2 — gangue slimes from coal mine "Slupiec"

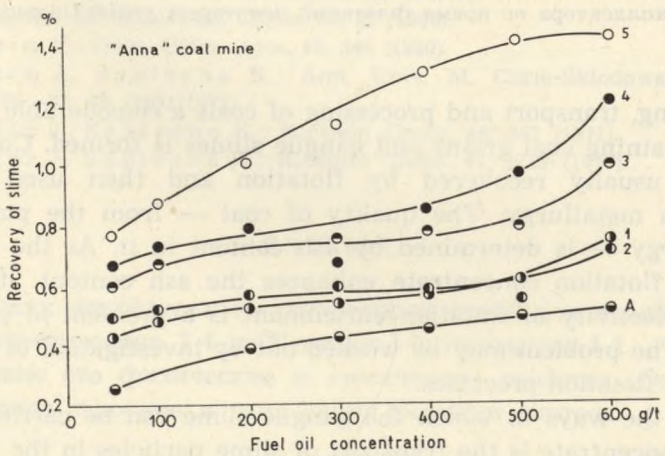

Fig. 2. Recovery of slimes vs. fuel oil concentration. Coal mine "Anna". Concentration of Alifal in grams per ton of solid: A — without Alifal, 1 — 25, 2 — 50, 3 — 75, 4 — 100, 5 — 150

tation pulp contains 200 grams of solids per liter and the gangue slimes content in the solids is about 25%. It was assumed that the absence of coal grains did not affect the results of the experiment. The following flotation reagents were used: fuel oil — used as collector in flotation of coal, and Alifal (trade name of a mixture of short-chain alcohols) — used as the frother.

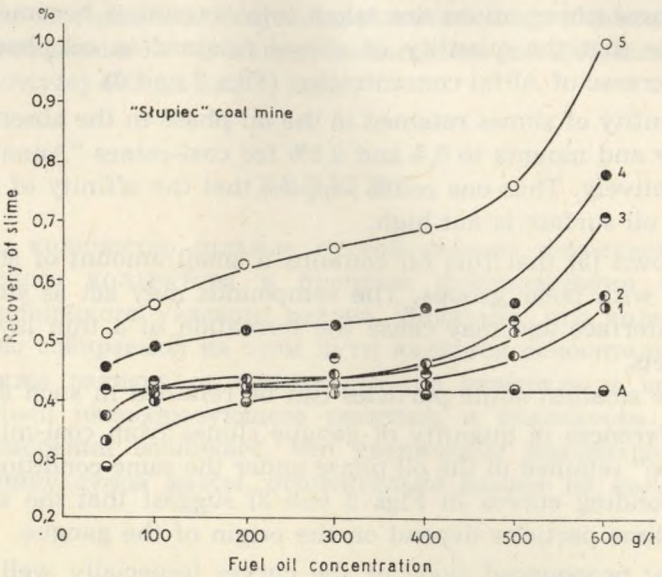

Fig. 3. Recovery of slimes vs. fuel oil concentration. Coal mine "Słupiec", A and 1—5 see Fig. 2

Granulometric analysis [3] of the gangue slimes showed that the distribution of slime particles according to their size was very similiar for gangue from both coal mines (Fig. 1).

After shaking, the oil phase in the funnel was separated and the quantity of slimes in it was determined gravimetrically.

RESULTS AND DISCUSSION

In Figs 2 and 3 are presented the curves obtained with materials from coal mines "Anna" and "Słupiec" respectively. It can be seen that the quantity of gangue slimes retained in oil phase is not considerable and amounts — for the highest reagent concentration used — to about 1% (for slimes from coal-mine "Anna") and 1% (slimes from coal-mine "Słupiec"). The quantity of slime carried out increases as the concentration of fuel oil increases, which can be explained directly by the increase of the area of the oil-water interface.

It was found elsewhere [4] that the quantity of slime particles carried out by the air bubbles increased as the thickness of water layer attached to the bubbles increased. The thickness of the water layer attached to an air bubble or to an oil droplet [1, 2] becomes greater as the concentration of a surfactant increases.

When these observations are taken into account it becomes quite understandable that the quantity of slimes retained in oil phase increases with the increase of Alifal concentration (Figs 2 and 3).

The quantity of slimes retained in the oil phase in the absence of Alifal is quite low and mounts to 0.4 and 0.5% for coal-mines "Anna" and "Słupiec" respectively. Thus one could suppose that the affinity of slime particles to fuel oil surface is not high.

It is known [5] that fuel oil contains a small amount of some organic compounds with polar groups. The compounds may act as surfactants at oil/water interface and may cause the formation of a thin layer attached to oil droplets.

Only the smallest slime particles can be retained in such a thin layer.

The differences in quantity of gangue slimes from coal-mines "Anna" and "Słupiec" retained in the oil phase under the same conditions (compare the corresponding curves in Figs 2 and 3) suggest that the surface properties of slime particles depend on the origin of the gangue.

The most pronounced slope of the curves (especially well marked in Fig. 3) at the highest concentration of fuel oil suggests that the use of excessive amount of fuel oil may enhance in some degree the ash content in flotation concentrate. On account of such a way of gangue slime transport into the flotation concentrate, the concentration of the collector must not exceed the value of about 600 grams per ton of solids.

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STRESZCZENIE

Oszacowano ilość szlamów skały płonej wynoszonej z kropelkami apolarnego zbieracza w procesie flotacyjnego wzbogacania węgli z Rybnickiego Okręgu Węglowego. Stwierdzono, że ilość skały płonej wynoszonej tą drogą jest stosunkowo niewielka, a także zależy od pochodzenia minerału

i rośnie wraz ze stężeniem odczynnika pianotwórczego i zbieracza. Z przeprowadzonych pomiarów wynika, że niekorzystne jest zwiększanie stężenia kolektora powyżej 600 g/t suchej masy.

РЕЗЮМЕ

Оценено количество шламов пустой породы извлекаемой каплями аполярного коллектора в процессе флотационного обогащения угля из Рыбницкого углевого района. Доказано, что количество пустой породы собираемой на этом пути является относительно небольшой, а также зависит от происхождения минерала и возрастает с концентрацией пенообразующего реактива и коллектора. Из приведённых измерений возникает, что увеличение концентрации свыше 600 г на тонну сухой массы, отрицательно влияет на коллектор.