

## INTERRELATION BETWEEN THE CONSTITUTION OF THE THREE-PHASE FROTH AND THE DENSITY OF THE FLOTATION PULP

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### ABSTRACT

The constitution of the three-phase froth is decisive for the selectivity of the running flotation process. The influence of the density of the flotation pulp is investigated as on the process of secondary enrichment of the concentrate also on the selectivity of the process of precipitation of the minerals from the three-phase froth with the drainage waters. This connection of secondary enrichment is investigated as contrary to the hydrophobicity of the minerals and thus with the size of the mineral particles. Key words: three-phase froth, solid mass, lamella liquid.

### INTRODUCTION

The flotation like a process running at the boundary of three phases in contrast to a number of other technological processes at which a fundamental role plays the two-phase froth, prevails over the properties and configuration of the three-phase froth. This is the froth that except some air and water contains a further solid particles, stabilized over the air bubbles and forming the three-phase froth. Its important parameters have a direct relation to the process of selection of the minerals and they are:

- modification of the constitution of the three-phase froth as a whole and the form of the bubbles in particular on the height of the froth layer;
- the quantity of solid mass arrested in the three-phase froth;
- the quantity of some lamella liquid and the velocity of its drainage;
- kinetics of breaking of the three-phase froth;
- the modification of the composition of the solid mass on height in section.

From everything said above it follows that between the parameters characterizing the three-phase froth and the selectivity of the froth process exists a relationship. From this relationship follows the possibility for an existence of a relation between the density of the flotation pulp and the constitution of the three-phase froth. Such relationship in a technological aspect examines like a component of the relationship of the selectivity of the flotation from the density of the flotation pulp.

### TECHNIQUE USED IN THE INVESTIGATION

A special technique is prepared for a realization of the investigation described below. Some elements were completed for it like these:

- a glass pipe of height 1 m and diameter 25 mm. In the lower end of this pipe is fixed shot filter which feeds some air under pressure from a compressor. The compressor is supplied of a precise manometer and a flowmeter for the air under pressure;
- the glass pipe uses like a flotation machine for a cleaning operation while the flotation runs at a variable content of the solid phase in the pulp. The litre weight of the flotation pulp measures when is fed for cleaning;
- additional reagents do not feed;
- a constant residence concentration of the flotation reagents holds up while the dilution for a change of the density of the pulp accomplishes with some filtrational water from rougher flotation;
- the concentrate for each experiment extracts by means of flotation of copper ore in the scheme of the figure 1;
- the glass pipe in the upper end is graduated in 5 mm where the correspondent froth layer extracts by means of siphoning.

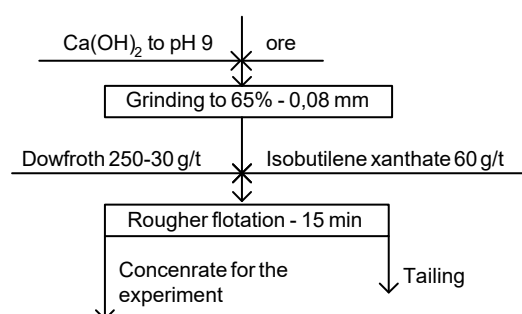


Figure 1. Flowsheet of the experiments for receiving of collective copper concentrate

## EXPERIMENTAL PART

Three series of experiments are carried out. The first series of experiments had for a purpose to check the relation between the height of the froth layer and the content of solid by weight in the pulp. Received results are given in figure 2. They show that the relationship between the thickness of the froth layer and the content of solid measured in percents, is not proportional and has exponential character.

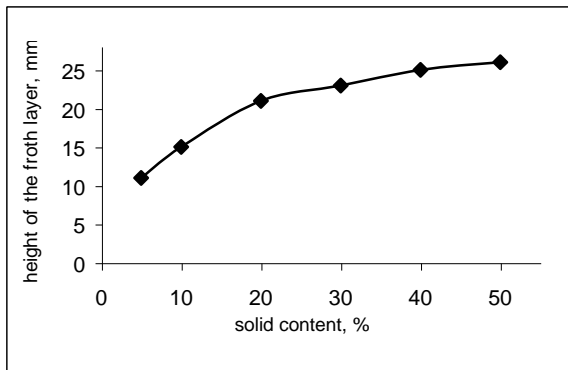


Figure 2. Relationship of the thickness of the froth layer from the percent solid in the flotation pulp

The second series of experiments investigates the relationship between the content of solid in the pulp and the change of the content of copper by height of the froth layer. The layers were taken down with a thickness 5 mm by means of siphoning. Sum probe of 10 experiments was given for an analyses. The received results are given in figure from 3 to 5.

The kinetics of the shrinkage of the three-phase froth in a relationship of the content of a solid mass in the flotation pulp was followed by means of the third series. The received results are given in figures 6 and 7.

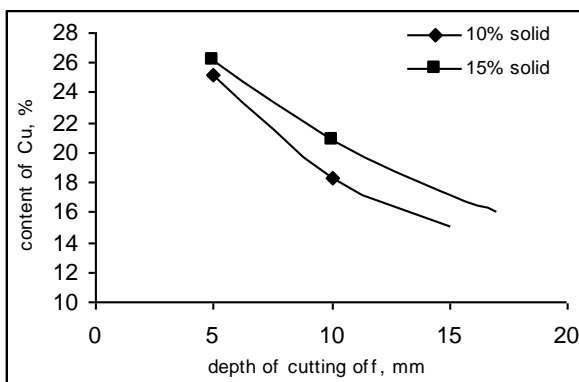


Figure 3. Modification of the content of copper by height of the froth layer at content of solid in pulp 10 and 15%

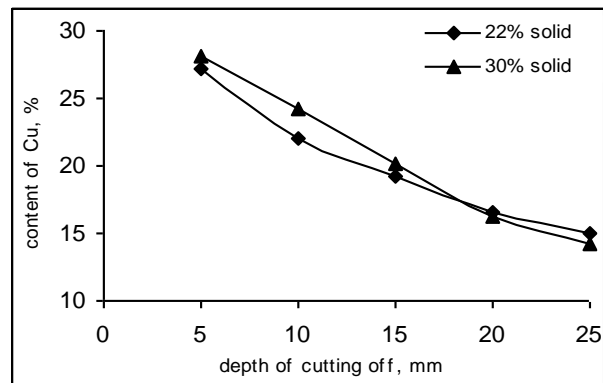


Figure 4. Modification of the content of copper by height of the froth layer at content of solid in pulp 22 and 30%

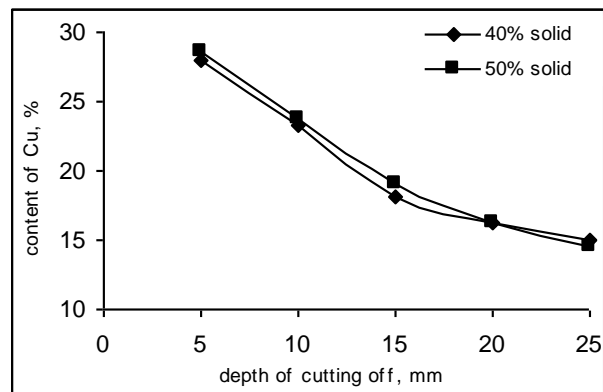


Figure 5. Modification of the content of copper by height of the froth layer at content of solid in pulp 40 and 50%

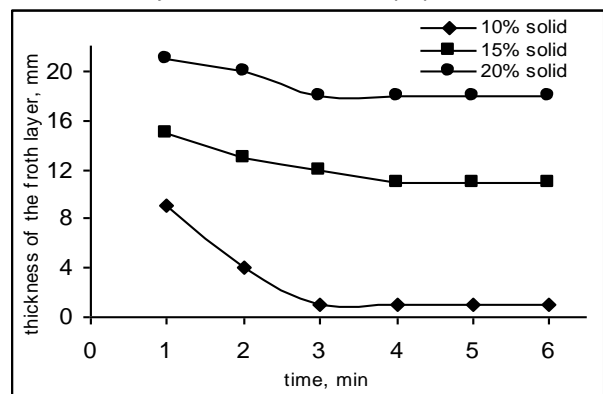


Figure 6. Kinetics of shrinkage of the froth layers at 10, 15 and 20% solid phase in the flotation pulp

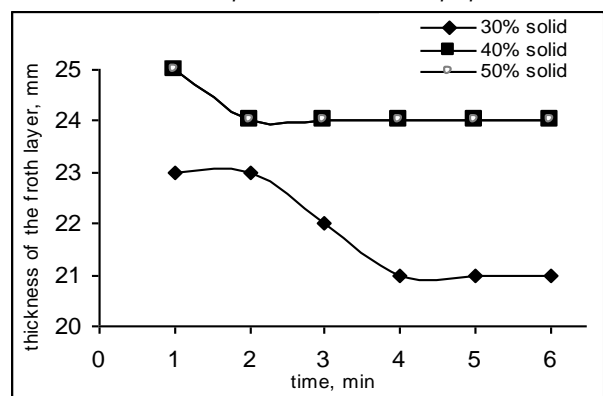


Figure 7. Kinetics of shrinkage of the froth layers at 30, 40 and 50% solid phase in the flotation pulp

## DISCUSSION OF RESULTS AND CONCLUSION

The results received from the conducted investigation show the following:

1. The density of the flotation pulp influences thoroughly on the process of the secondary enrichment of the concentrates in the froth layer.
2. The secondary enrichment of the concentrates is caused from the differences in the hydrophobicity of the mineral particles participating in them. The drainage waters at the coalescence of the air bubbles in the froth layer carry away with themselves more hydrophilic particles which do not succeed in forming an three-phase perimeter of watering after the coalescence of the bubbles. This succeed to realize only sufficiently hydrophobic particles.
3. The secondary enrichment is more strongly expressed at flotations with lower density of the pulp. The degree of the enrichment decreases when the density increases. The most probably reason is higher degree of filling of the boundary water-air with flotation particles still in the process of flotation. This competition after a definite density of the flotation pulp allows the flotation only to sufficiently hydrophobic mineral particles therefore the selectivity of the process increases.
4. The faster breaking of the froth at the low density of the pulp most probably is connected with lower degree of mineralization. According to the Rebbinder's theory, the mineral particles in the three-phase froth mineralizes it.
5. The practice in leading of the flotation into cleaning operations at low density of the flotation pulp is wrong. The

flotation front of the cleaning operations has to calculates at a density that depends on the density of the concentrate in rougher flotation at a minimum expense of some transport water. It is advisable for that purpose the cascade arrangement of the cleaning operations independently on the type of the flotation machines.

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