MSCA-ETN SULTAN

European Training Network for the Remediation and Reprocessing of Sulfidic Mining Waste Sites

Innovative ultra-fine particle flotation through agglomeration for the re-processing of sulfidic tailings

Ana Luiza Coelho Braga de Carvalho (ESR6), Dr. Daniel Goldmann, Dr. André Carlos Silva

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Introduction

Objectives and milestones

Development of direct flotation techniques for the reprocessing of tailings; identification of new flocculants for selective flocculation.

Proof-of-principle achieved showing that selective flocculation strongly improves material recovery and selectivity during flotation using generic materials and transferring that successfully to tailings from SULTAN materials

Methodology

The flocculation characteristics of SUL_GM_09_QUARTZ, SUL_GM_05_CHALCOPYRITE and SUL_GM_08_PYRITE were studied. For flocculation tests, minerals were pulverized (P80<20 μm) using a disk mill.

Flocculation Tests – Phase 1

Table 1: Parameters of the first phase of flocculation tests

CONSTANT	
Solids concentration (%)	2,5
Pulp volume (mL)	200
Dispersion time (s)	30
Flocculant*	Superfloc N100
Sedimentation time (min)	5
VARIABLE	**Range**
Stirring speed (rpm)	200 - 500
Stirring time (min)	1 - 5
pH	9 - 12
Flocculant dosage (g/t)	10 - 100

*Non ionic polyacrylamide

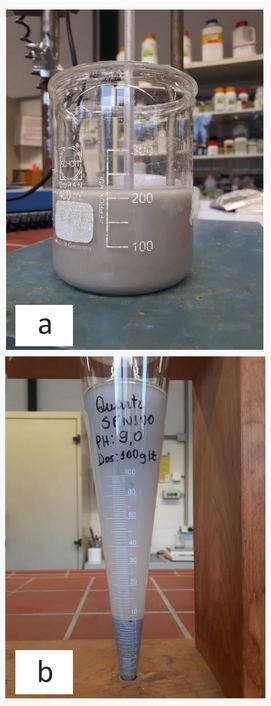


Figure 1: Flocculation test. (a) Flocculation; (b) Sedimentation.

Flocculation Tests – Phase 2

Table 2: Parameters of the second phase of flocculation tests

PARAMETERS	
Solids concentration (%)	2,5
Pulp volume (mL)	600
Flocculation time (min/dose)	2
Stirring speed (rpm)	200
pH	10
Flocculant dosage (g/t)	10 - 100

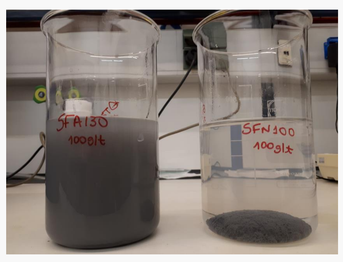


Figure 2: Quartz flocculation using SFA130 and SFN100.

The optimized parameters from phase 1 were used and flocculation measurements were performed with Flocculus® sensor, which is based on the reflectance measurements. Three polyacrylamides were used. Besides the non-ionic polyacrylamide, two anionic polyacrylamides were tested: Superfloc A130 (SFA130) and Superfloc A150 (SFA150), all supplied by Kemira.

Results

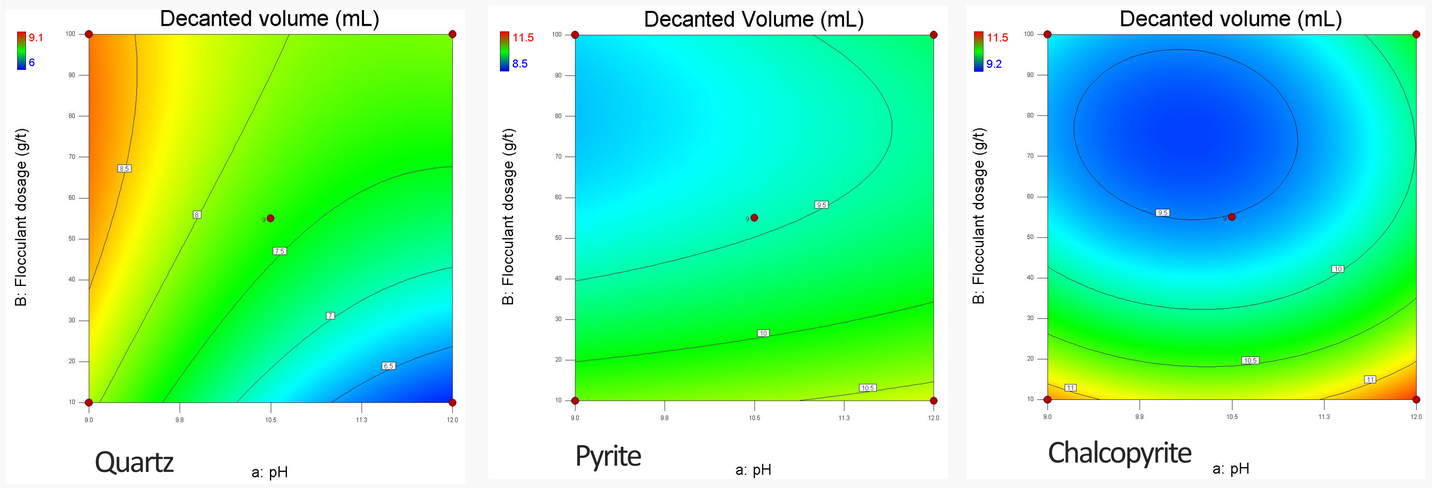
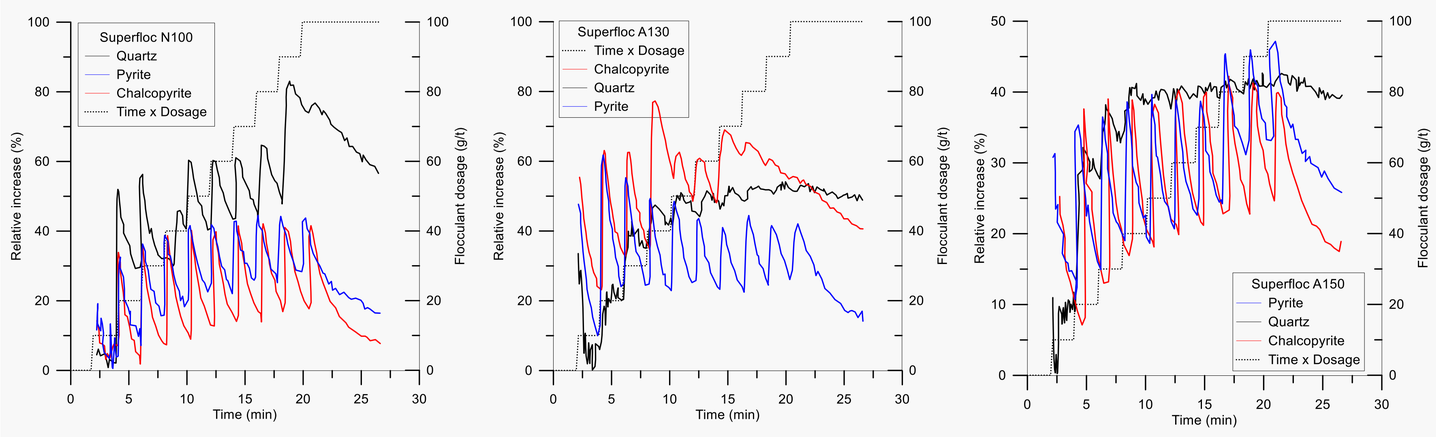


Figure 3: Decanted volume using a non-ionic polyacrylamide Superfloc N100.

The saw shape of the graphs in Figure 4 is attributed to floc instability over time, which is almost non-existent for quartz using 40 or 50 g/t of flocculant for anionic polyacrylamides SFA130 and SFA150. The SFN100 provides relative growth for quartz flocs of 80% using 90 g/t of flocculant , while for sulfides the growth of flocs is only 40%. The SFA130 generates for chalcopyrite a peak close to 80% using 40 g/t of flocculant while for the other minerals the growth of flocs is close to 50%. The flocculant SFA150 had the lowest flocculation results, presenting a relative growth of only 40%, 25% and 20%, respectively for quartz, pyrite and chalcopyrite in the dosage of 100 g/t of flocculant.



(a) (b) (c)

Figure 4: Flocculation tests using non-ionic and anionic polyacrylamides (a) Superfloc N100, (b) Superfloc A130 and (c) Superfloc A150.

Conclusion

In general quartz flocs trend to be much more stable than sulfide flocs. At pH 10, with Superfloc N100 a potential "selectivity window" can be generated using 90 g/t against the sulfidic minerals. Using Superfloc A130 (40 g/t) a selective flocculation of chalcopyrite could be possible. Under the conditions studied, with SFA150 the relative growth of the three minerals is very similar throughout the dosage range studied, demonstrating a lack of selectivity.

Upcoming Steps

From February to May 2020, a secondment will be done at the University of Oulu. During this period tests will be carried out with different flocculants, with mineral mixtures, and flocculation followed by flotation tests using both conventional and customized (by ESR4) collectors.

Contact:
Ana Luiza Carvalho, M.Sc.
TU Clausthal, Institut für Aufbereitung, Deponietechnik und Geomechanik
Walther-Nernst-Straße 9, 38678 Clausthal-Zellerfeld, Germany

Phone number: *+49 5323 72-2136*
E-Mail: *alcbdc18@tu-clausthal.de*
Website: *www.ifa.tu-clausthal.de*

TU Clausthal
Clausthal University of Technology
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