

# **AMINPRO – FKT, SKT and SKT-WS Flotation Kinetic Testwork Procedures**



## Introduction

In performing rougher flotation testwork, current data interpretation methods allow for a single test to define the effect of grind on kinetics of a sample. The kinetics is represented by the rate constant, **k**, and the maximum recovery, **Rmax** in the plug flow rate equation

$$\text{Rec} = (1 - e^{-kt}) \text{Rmax}$$

Multiple flotation tests are no longer necessary to define the effect of grind on recovery. The relationship between **Rmax**-grind and **k**-grind can now be done using the **FKT** procedure. In this test, the kinetics are defined as a function of particle size by solving a series of simultaneous equations such that

$$\text{Rec Total} = \sum \text{Rec}_i = \sum (1 - e^{-k_i t}) \text{Rmax}_i$$

Where **i** is the *i*th particle size. By changing the feed size distribution, can the total recovery be determined at any time for a P80 grind.

The simplified version of an FKT test, is an SKT test. The SKT test is used to check the ores variability. This test yields a single value of **Rmax** and **k**.

The SKT-WS is a modification of the SKT test in that it has a settling test done on the tailing sample.

The global procedure for these tests are:

- Grind sample of **X** weight to approx. P80 desired
- Place ground sample in flotation cell
- Remove 300g solid feed material prior to flotation for assaying and screening
- Float **X-300** g for discreet intervals.
- Weigh wet, filter, dry and re-weigh concentrates and tailing.
- Prepare for assays and microscopy.
- Perform Screen Analysis on Feed (FKT,SKT,SKT-WS) and Tails (FKT) and assay the screen fractions
- Enter data in standard formatted table.

## Procedure Details

### *Sample Prep:*

A representative sample of 2.5 Kg should be crushed to -10 Mesh without over-crushing. In other words, as material is crushed, only the +10Mesh portion should be returned to the crusher for further size reduction.

Of the 2.5 Kg sample, riffle out **X** g of sample. As the test requires a screen analysis of the flotation feed sample, it is recommended that sufficient sample is ground in a mill to generate approximately 300 g for the head sample and screening and the remaining for flotation. The amount required for flotation must be equal to the % solids of the actual plant flotation feed stream. Thus, if we let **X** be the total sample required for grinding in grams, the weight is calculated from:

$$\mathbf{X} = \mathbf{V_{float\ Cell}} / [ (\mathbf{100-\%Sol})/\%Sol + 1/sg_{sol} ] + 300$$

Where **%Sol** is the solids of the plant, **V<sub>float Cell</sub>** is the volume of slurry the cell requires at the start of the lab flotation test (in milliliters) and **sg<sub>sol</sub>** is the specific gravity of the solids material being floated. Prepare all the samples by placing them into plastic bags. If the sample deteriorates rapidly with time, vacuum pack the sample or place it in a plastic bag and refrigerate or fill with an inert gas (Argon/Nitrogen) and seal.

### *Grind:*

- Prepare/clean grinding mill for test (record ball load: Wt/Charge-size), RPM
- Add **X** g to ball mill
- Add water to make up 62% solids
- Add reagents (lime, collector, frother) as per detailed client procedure.
- Grind for sufficient time to yield the target P80 grind<sup>1</sup>
- Removed slurry from grinding mill (Use as little water as possible)

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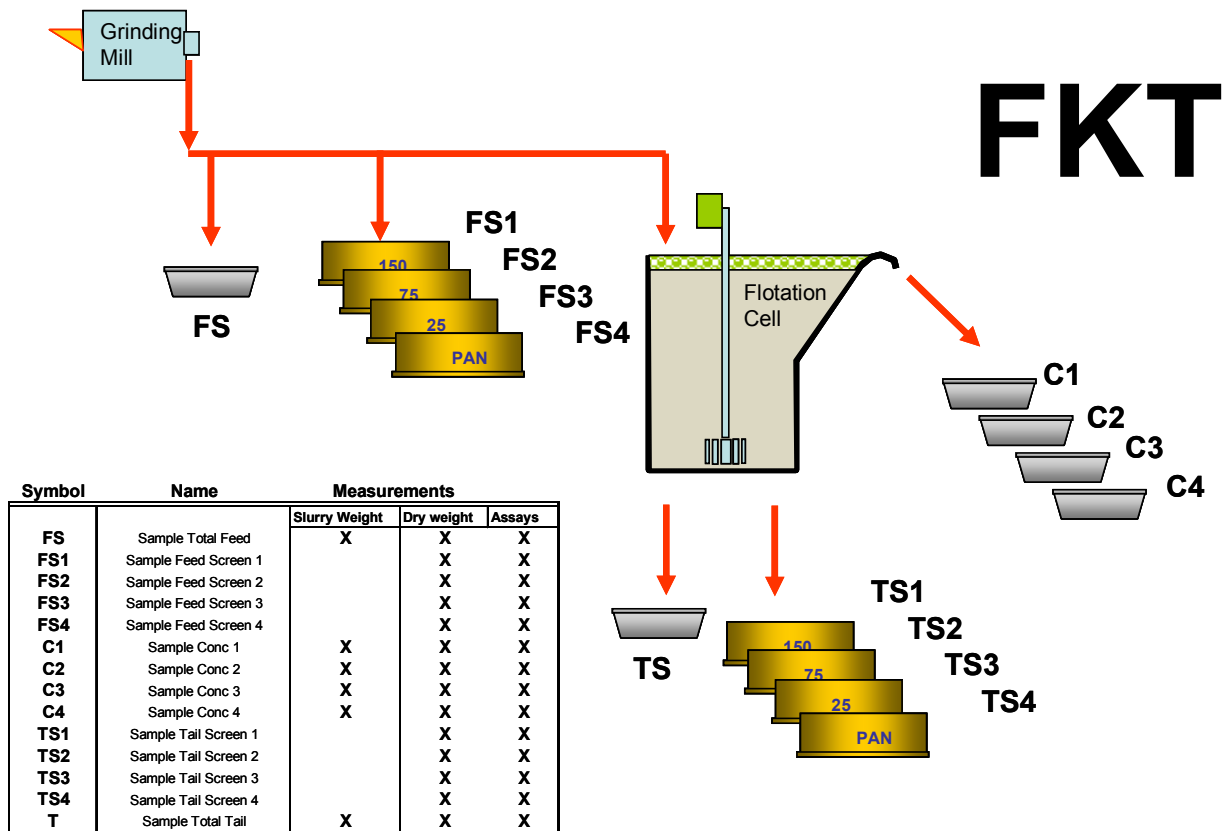
<sup>1</sup> The target P80 normally is 150 microns +/- 10 microns. The P80 grind of an FKT test does not have to be exactly 150 microns as the output of this test is an equation of Rmax and k as a function of particle size. The overall average Rmax and k for the test can therefore be computed for the exact target P80.

*Extract the 300 g head sample*

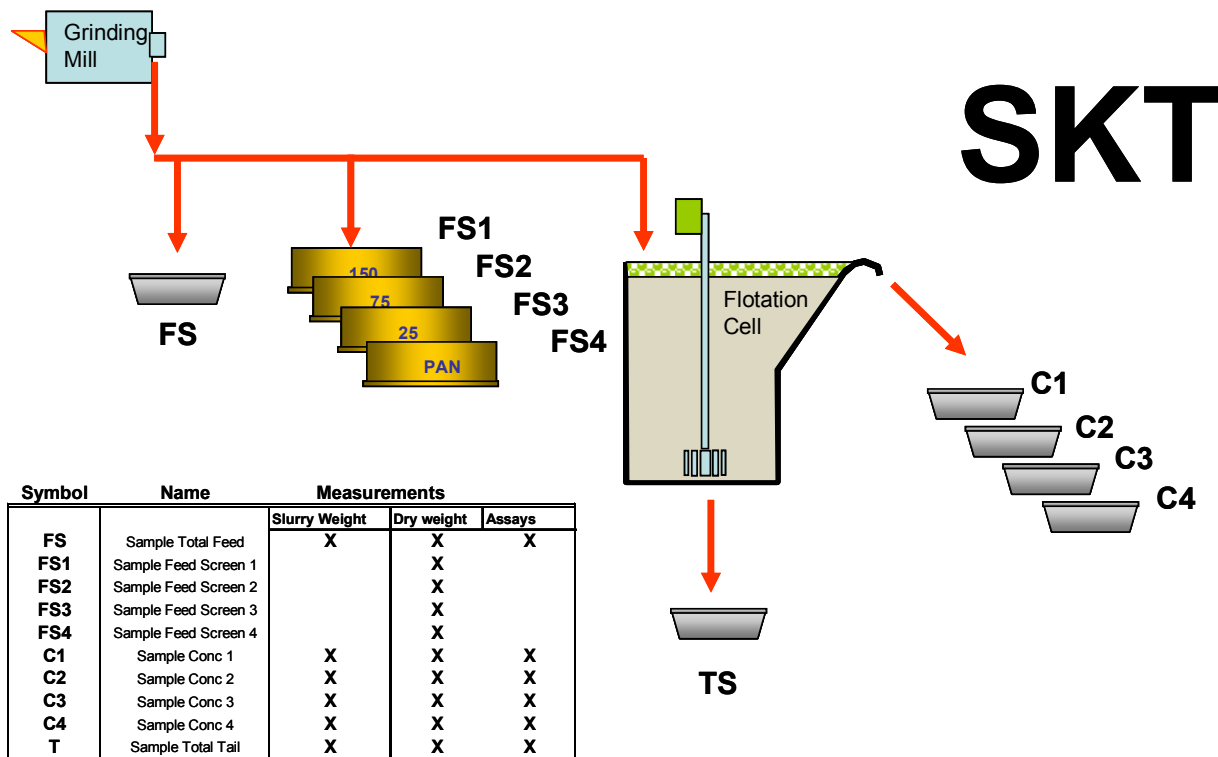
- Place the product of the grinding mill in the flotation cell
- Fill with water to a known volume of slurry
- Estimate the volume that needs to be extracted to get 300 g of solid sample.
- Siphon the sample into a graduated cylinder to the volume desired
- Dry the 300 g head sample for assay and screening.
- You are now ready to do the FKT, SKT or SKT-WS test.

*Schematic procedure of the Flotation Tests*

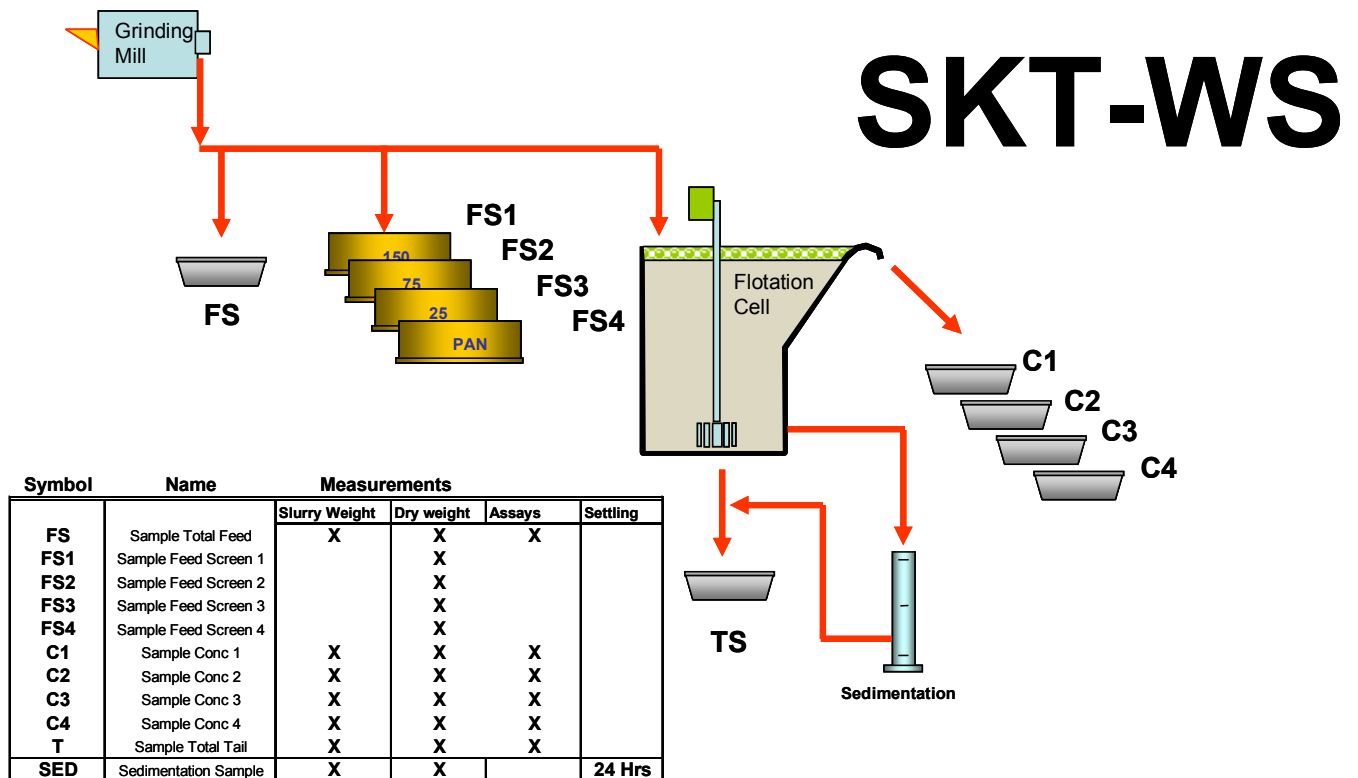
**FKT Test:** Perform screen analysis on FEED and Tails and follow the Procedures shown below:



**SKT Test:** Perform screen analysis on FEED only and follow the procedures shown in the diagram below



**SKT-WS (With settling test):** is the same as an SKT, but do a settling test on a predetermined weight of tails before filtering (by taking a corresponding volume of slurry from the agitated pulp). The settling test must be done over a 24 hour period using an optimized dosage of flocculant. If the target tail density has not been achieved, prolong the test until it does. The test is to be done with a feed slurry density between 8 and 10% solids by weight.



### *Detailed Procedure for Flotation*

- Prepare cell for flotation (measure air, auto-level system, set RPM).
- Place the agitator in the cell and turn on without splashing (and no air).
- Add filtrate water from previous tests (if available) to the cell and bring it near desired level for flotation. Otherwise use a pH conditioned water<sup>2</sup>
- Set cell on auto-level mode if possible.
- Add reagents as per client procedure (start with lime/pH/redox)
- Condition 1 minute.
- Turn air on to optimized level.
- As soon as the concentrate appears, start the clock and start removing concentrate<sup>3</sup>.
- In the absence of an automatic level control system, frequent adjustment of the pulp level will be required as the test proceeds. Do these adjustment by adding water.
- Separate concentrates for the following intervals: 0-0.75 min, 0.75-2 min, 2-8 min, 8-30 min.
- No squirts of water are allowed on the cell's lip at any time. No water addition is allowed to the concentrate pan, at least until it has been weighed. This is because the Aminpro FKT and SKT tests require accurate readings of the % solids of each concentrate produced.
- Clean the cell side walls some 30 seconds prior to the end of a time interval.
- Do not scoop into the pulp!! .
- At end of test, measure pH, redox and write down any test observation.
- All flotation tests must be backed with a flotation test form. This form must be made available electronically.
- Record all equipment dimensions, volumes, rpms, etc. so a third party can reproduce the testwork.

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<sup>2</sup> For any testwork, the water used should reflect the recycle water of a plant. For this, it is important that waters from a test program be kept for testwork. The starting volume of slurry must be marked on the cell interior wall. This is so that at the end of the test, the remaining tails can be brought back in volume to the marking.

<sup>3</sup> At the start of the test, when the froth mineralization is most prominent, try to remove the froth as soon as the mineralization appears. You may automate the removal rate to one scoop per second as soon as the bulk of the mineralized froth has been removed.

### *Filter and Dry Flotation Products*

- At the end of the test, ensure that all wet weights are written down from the tailings and concentrates products. Weigh the flotation cell with the slurry tails to the initial volume marking to obtain the tailings wet weight. Ensure no water is added to any of the concentrate samples prior to wet weighing.
- If the test has an SKT-WS procedure, after having weighed the wet tails, remove a known volume of stirred sample to yield between 8-10% solids feed in a settling test. And proceed with the settling test.
- Dry all flotation products and weigh.
- Estimate the % solids of all products including feed.

### *Buck samples and prepare them for assays and/or microscopy.*

- Prepare concentrate samples as follows:
  - Each concentrate must be dried
  - Split each concentrate interval into 2 portions: one for microscopy and one for assaying (elements and partial extraction) (weight ratio: 1/9 respectively)
  - The portion being assayed must be pulverized.
- Prepare the Feed and tailings sample as follows:
  - For an FKT test, feed and tailing need to be assayed and in addition need to be screened and each screen fraction also needs to be assayed. The SKT tests need feed and tailing assays and only the feed needs to be screened and does not need to be assayed
  - The samples of feed (300 g) and tails that need to be screened must produce 4 screen fractions. The product of each screen fraction must be split into two portions: one for microscopy and one for assays. The weights should be 1/9 respectively.
  - All samples destined for assays must be pulverized.
  - All samples going to microscopy must remain un-pulverized.
  - All reject samples must be bagged/labeled and kept.

### *Perform Screen Analysis on Feed and Tails*

- Both Feed and Tail samples (300 g each) must be screened accurately most likely on sizes 100Mesh, 200Mesh, 500Mesh and –500Mesh. The client will specify.
- The idea is to maintain the same screens for all the tests and to generate similar weights for each screen. It is always recommended that for typical porphyry ores, that the bottom screen be a 500 Mesh denomination. Under these conditions, the entire 300g sample must be wet screened on 500 Mesh. The oversize must be dried and re-screened on the upper screens. The undersize of the 500 Mesh screen can be filtered and dried. When the oversize is screened, there will always be some –500 Mesh material left that will need to be joined with the original –500 Mesh product from the wet screening operation. For dry screening, shake 20 min
- The screen denomination and the number of screens will depend on client requirements. It is recommended that only four screen be used as the costs for the test increases drastically with increased number of screens.

### *Reporting Results*

- All results should reported on a formatted spreadsheet provided by Aminpro. Results should be reported electronically.