



CM Solutions Laboratory Capabilities

Unit T5, Pinelands Office Park, 1 Ardeer Rd, Modderfontein
 082 441 2788 | 011 608 0019 | frank.crundwell@cm-solutions.co.za | www.cm-solutions.co.za

Process development

- Development of the metallurgical test plan
- Interpretation and modelling of test results
- Integration of test results in metallurgical design/plant operation

Analytical

- ICP-OES – multi-element analysis
- Wet chemistry
- Particle size distribution (PSD)
- pH, Eh, Conductivity, etc
- Water analysis

Mineral Processing

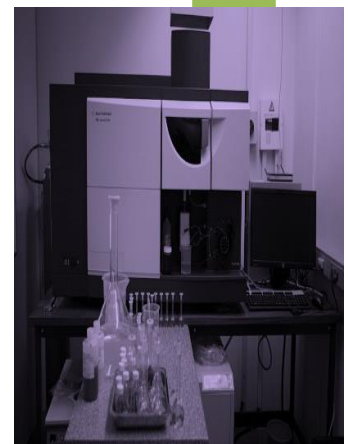
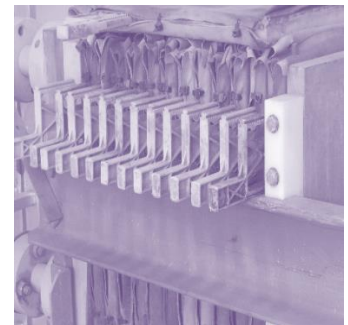
Area	Equipment and Tests
Flotation	Flotation rate, grade-recovery
Crushing	Crusher (jaw) and roll
Milling	Mill (rod and ball), milling curves
DMS / Heavy liquid	Float and sink analysis
T-type classification	Pilot test rig
Cyclone	Pilot test rig
Dewatering plant	Pilot test rig
Shaking	Shaking table
Spiral	Spiral test rig
Attritioning	Test rig

Solid liquid separation

Area	Tests	Equipment
Thickening	Settling test, Underflow density test Flocculant screening	Cylinder
Filtration	Filtration rate Filterability	Filter

Pyrometallurgy

Area	Tests	Equipment
Roasting	Sulfides, etc	Muffle furnace
Calcining	Lime	Tube furnace



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Hydrometallurgy

Area	Tests	Equipment
Leaching	Atmospheric	Open tanks
	Cyanidation	Closed tanks
	Pressure Oxidation	Bottle roll
	Heap	Parr
	Constant redox	Columns
	HPAL	REDOSTAT
	Oxygen consumption	Parr
	Gangue acid consumption	Open tanks
	Total acid consumption	Open tanks
	TCLP	End-over-end bottle roll
Agitation	Suspension, rheology	Viscometer
Precipitation	Batch tests	Open and closed tanks
	Continuous tests	
	pH Control	
	Lime, MgO, NaSH	
Solvent extraction	Isotherms	Shake flasks
	Organic testing	Pilot plant
	Diluent testing	
Ion exchange	Isotherms	Shake flasks
	Kinetics	Columns
Electrowinning	Anode materials	Cells
	Cathode	
	Chemistry	
	Cell design	
Carbon adsorption	Isotherms	Open tanks
	Kinetics	



Case studies of successful projects completed

Flotation for sample preparation, then multiple leaching tests:

The client had a limited quantity of feed sample. Existing flotation test procedures were followed to generate a concentrate which matched prior test work. Various leaching tests were then done on the sample (acid, alkaline, oxidising) to achieve a target product specification. The results were then used to evaluate several flowsheet designs (at a concept level). Capital and operating costs were determined, which were used in high-level project feasibility analyses.



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Magnetic separation tests:

The client provided large samples from various sections of their ore body. Individual and blended samples were subject to magnetic amenability tests to determine the benefit of upfront magnetic separation. Solids were analysed in-house.

Recycling of lithium batteries:

CM Solutions was awarded a research grant from the Green Fund. The goal of the work was to develop, to the concept level of design, a lithium battery recycling facility. This highly open-ended project spanned 18 months, and included research, test work, process design, mass balancing, cost estimation and financial modelling. The final report made recommendations for government regarding lithium batteries.

Upgrading of sand for glass manufacture:

Clients have approached CM Solutions for test work on sand samples to remove impurities. Sand for glass manufacture has strict requirements regarding purity. Test work included setting base-lines using acid leaching, as well as attritioning tests (under different conditions) to upgrade the samples. The highly-specialised analysis was contracted to a 3rd-party laboratory.

Whole-ore leaching pilot plant:

CM Solutions hosted and managed a whole-ore leach pilot plant. The plant ran in batches over several months, exploring multiple processing options. Vat and heap leaching options were explored. In addition several other industrial tests were conducted on a smaller scale in the lab (washability, acid regeneration). The test work was incorporated into a process design and mass balance completed by CM Solutions using Cycad process.

Lime slaking test work:

The project required testing the use of an attritioner to slake a burnt lime sample. Tests include lime activity, slaking rate. Process modelling was also included, using the lime characterisation test work results to model the anticipated maximum temperature expected.

Limestone characterisation:

Several projects for different clients have been conducted to characterise limestone. Several of the ASTM lime and limestone methods were conducted to determine characteristics such as available lime and calcium carbonate equivalence tests. In addition tests applicable to industrial application were conducted, such as neutralising capacity and settling rate. Limestone was also calcined under varying conditions to produce quicklime, which was then also characterised (purity, activity etc).

Continuous precipitation pilot plant:

CM Solutions was supplied with 3.5 tons of feed sample. This was bulk leached, and then processed through solvent extraction. The raffinate was then used as feed for a continuous precipitation circuit. The plant ran for 3 weeks, completing several different campaigns. Sample analysis and reporting was performed during the pilot run, allowing a draft report to be delivered in the week following the pilot plant shutdown.

