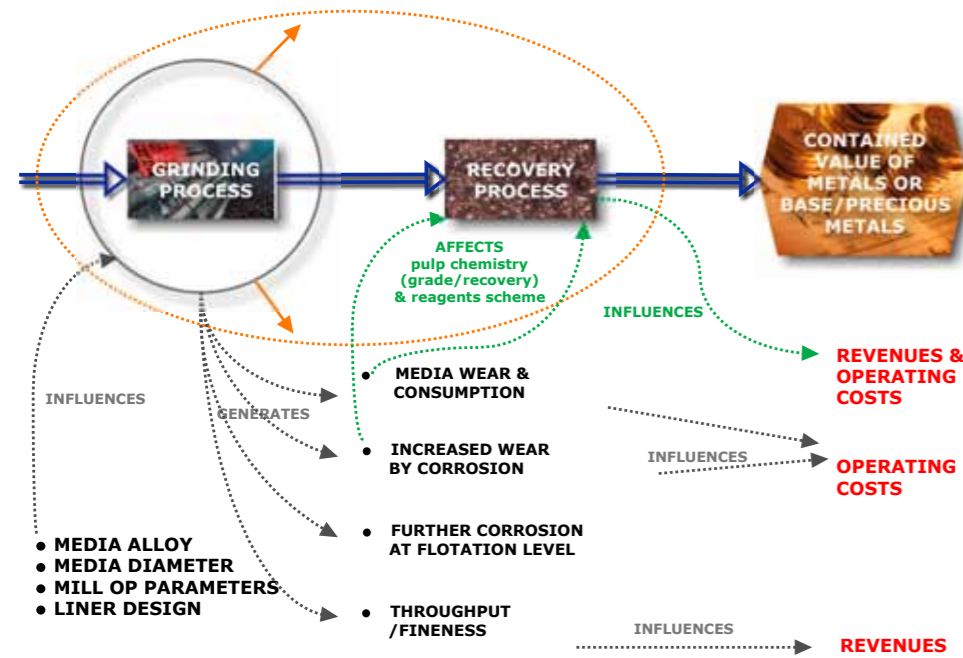


... A WORTHWILE INVESTMENT FROM GRINDING TO CONCENTRATION



Magotteaux promotes the use of inert grinding media as an effective method for preventing the forged steel grinding media corrosion products from contaminating the surface of valuable minerals.

In order to provide the best solution, Magotteaux has developed specific tools:

The Magotteaux Mill® to reproduce the pulp chemical conditions of the plant grinding mill in a laboratory. This gives a distinct advantage in

testing, as the results produced in the laboratory are now more representative of those which would be observed in the plant.

The Magotteaux Flotation Machine® which superiority lies in its design. Its bottom driven agitator allows the operator to remove froth from the entire surface area of the float cell. Its probes remain in the pulp the whole time, allowing the user to continuously monitor pulp chemistry and add chemicals at any stage.

Magotteaux realise the potential benefits of our media to the mining industry and the value of providing a more integrated, scientific approach to media selection.

Opening up your mine to Magotteaux ensures you access the advantages of its unique product range as well as to a high added value technical knowledge.

The benefits of high chromium grinding media:

- reduced wear;
- optimised reagents addition
-> reduced operating costs;
- improved metallurgical performances through altered pulp chemistry i.e. cleaner mineral surfaces; -> increased revenue.

DO NOT MISS THE OPPORTUNITY!
CALL ON US

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North America: +1 615 385 3055
South America: +56 2 632 6642
Africa: +27 11 467 0240
Australasia: +61 8 9322 3255
or
downstreamprocessing@magotteaux.com

VISIT OUR WEBSITE
www.magotteaux.com

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GO INERT



MAGOTTEAUX
SHAPING A WORLD OF PERFORMANCE

INERT GRINDING MEDIA... TO LIMIT MEDIA WEAR AND ACHIEVE IMPROVED RESULTS

MAGOTTEAUX is the pioneer in advanced metal, ceramic and composite materials, specializing in grinding media and wear resistant castings.

Our primary aim is to build a strong, long lasting, and open partnership with our customers through the provision of sound technical advice that propose the best alloy selection to minimise production costs and increase revenue.

Through our world-wide network of 13 production units and 28 sales offices, we are able to offer our customers a fully integrated and optimized solution to their grinding problems. From the selection of the best wear resistant alloy to its impact on grinding chemistry and the subsequent separation process. Research and experience have indicated that there are three main causes of media wear in a wet system:

- Impact,
- Abrasion,
- Corrosion.

In particular, it has been documented that corrosion increases with the use of reactive sulphide minerals and is potentially responsible for more than 50% of total wear. Forged steel grinding media corrosion products (iron oxy-hydroxides) contaminate mineral surfaces, leading to a reduction in their metallurgical response.



MAGOTTEAUX mill



MAGOTTEAUX floatcell

THE MAGOTTEAUX APPROACH: INERT GRINDING MEDIA

In concert with our traditional approach of determining media wear through technical segmentation and validation, thanks to a marked ball test, a robust experimental methodology is applied to existing plants.

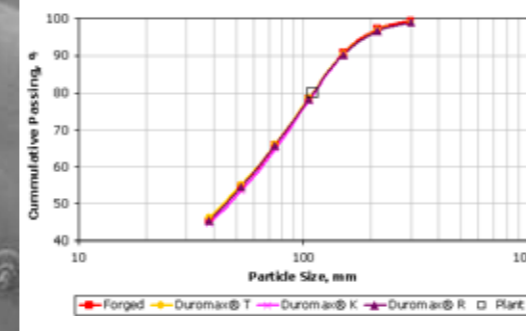
PHASE 1 - Plant data collection

Complete a pulp chemical and EDTA survey of the grinding and flotation circuit. Determine the oxygen demand through the circuit. Conduct a metallurgical survey of the flotation circuit (for scale-up). Collect a bulk sample of ore for further testing.

PHASE 2 - Magotteaux Mill® calibration

The objective of the calibration process is to produce a laboratory mill discharge which has the same particle size distribution as the conditioned flotation feed, and the pulp chemistry of the plant grinding mill discharge.

- Match the particle size distribution for each media type to the plant.



- Determine the plant pulp chemistry target

Process stream	Pulp chemical parameters			
	pH	Eh, mV (SHE)	DO, ppm	t °C
Cyclone underflow	8.0	200	4.0	31.0
Ball mill discharge	8.0	-80	0.5	35.0

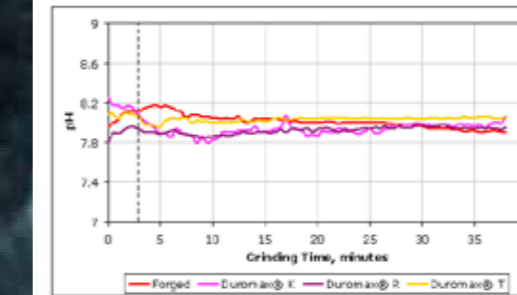
- Develop the "recipe" to achieve the pulp chemistry for forged steel and save to the control system so that it can be replicated for other media types.

PHASE 3 - Media testing

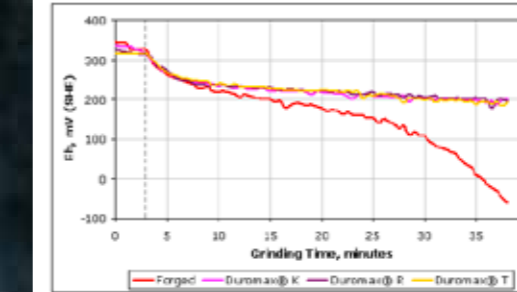
Once the calibration has been achieved it is time to determine the impact of the grinding media on the chemistry and flotation response.

This comparison can be obtained because the particle size distribution and the pulp chemistry "recipe" are the same for all tests, and the only intentional change is the grinding media. Therefore, any variation in the pulp chemistry and metallurgical response can be attributed directly to the grinding media composition.

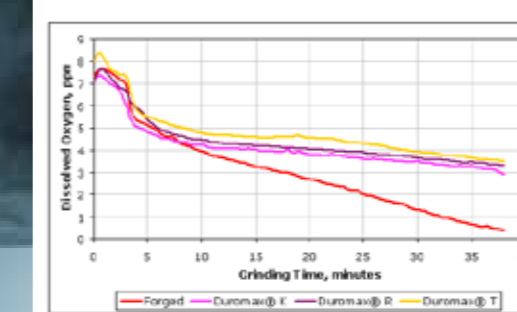
pH profile during grinding



Eh profile during grinding



DO profile during grinding

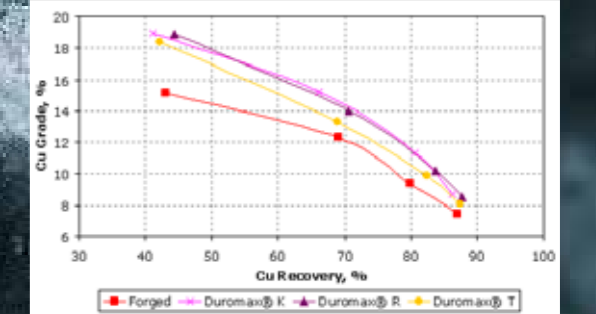


In the example, the pH of the system remained the same for all grinding media, changing from forged steel to high chrome grinding media resulted in a significant shift in Eh (nominally 250 mV) to more oxidizing pulp potentials, and lower dissolved oxygen in the pulp.

The change in pulp chemistry is related to the differences in the corrosion mechanism between forged steel and the high chrome alloys. This is illustrated by the decrease in the

EDTA extractable iron from 4.6% for forged to 2.8% for the Duromax® alloys.

Accompanying the changes in pulp chemistry are changes in the surface chemistry of the sulphide minerals present in the pulp, and it is apparent that pulp prepared using high chrome grinding media produced a superior copper grade recovery curve to that obtained when the ore was ground with forged steel.



In this example, at 10% copper rougher concentrate grade the copper recovery increased by at least 4.3% when the ore was ground with Duromax® T (vs forged steel). Gold recovery also improved.

Media type	Recovery, %	
	Cu	Au
Forged steel	77.6	62.5
Duromax® K	83.5	66.2
Duromax® R	84.2	69.2
Duromax® T	81.9	65.9

Economically, a 1% increase in copper and gold recovery in a 10 million tonne per annum concentrator, with copper and gold head grades of 1% and 0.5g/t (with metal prices of: \$ 9,000/t and \$ 1,500/oz) is worth \$ 9.0 million and \$ 2,68 million, per year respectively.