

# PGM Flotation Advances

## New Technology for Treatment of PGM Ores - Recent Development and Capabilities

### BACKGROUND

Extensive R&D programs have been undertaken at SGS Lakefield Research in recent years, to develop new technology to improve platinum group metals (PGM) metallurgy. This resulted in the development of new modifiers/depressants, clay dispersants and PGM collectors. These new reagents can result in a significant improvement of PGM concentrate grades and recoveries and are readily transferable to operating plants.

### DEPRESSANTS FOR FLOATABLE GANGUE

Many of the conventional reagents used in the PGM industry for the depression of floatable, non-sulphide gangue minerals, are also sulphide mineral (PGM carriers) depressants, which can cause a reduction in the flotation rate of PGM. A new group of highly effective and more selective gangue depressants from the PD series has been developed, and are now commercially available.

The use of these depressants on an ore that contained floatable gangue resulted in improved PGM concentrate grade from 80 g/t total PGM to over 300 g/t PGM, without any loss in recovery.

### CLAY SLIMES DISPERSANT/DEPRESSANT

Clay-like slimes are present in varying amounts in a number of South African and Australian plants treating PGM ores. These slimes lower PGM recovery and selectivity, especially towards chromium, even when they are present in small amounts. This poor selectivity is due to the fact that collector requirements are relatively high in the presence of these slimes. This problem has not been properly recognized in the past.

Significant progress has been made in the development of clay dispersant/depressants resulting in substantial improvement in metal recovery from clay-containing ores, as well as a reduction in collector consumption.

One of the new clay dispersant/depressants (QR4) has been introduced into an operating plant treating gold ore. A dramatic improvement in gold recovery and a reduction in collector consumption, was observed (Table 1). Two groups of these

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reagents (the QR series and DQ series) are available for different types of clay minerals.

**Table 1. Metallurgical Results Obtained Using QR4 Clay with High Clay Gold Ore QR4**

Reagent QR4	Collector Consumption	Conc Grade, g/t		% Recovery	
		Au	Ag	Au	Ag
0 g/t	260 g/t	70	250	75.5	46.7
150 g/t	180 g/t	110	360	81.6	55.0
300 g/t	150 g/t	120	400	86.7	60.1
500 g/t	80 g/t	160	500	92.2	75.5

## NEW PGM COLLECTORS

New collectors based on xylene chemistry have been developed, and are highly beneficial for treatment of PGM-containing ores. These collectors are particularly effective in treating partially oxidized PGM ores and ores containing PGM as alloys. A typical example of the collector KZ-22's performance on a partially oxidized, high chromium PGM ore is illustrated in Table 2. Collectors from the PM series have also been shown to be very effective for the flotation of PGMs.

**Table 2. Effect of Collector KZ-22 on PGM Flotation from an Australian Ore**

Collector Type	PGM Rougher Concentrate				PGM Rougher + Scavenger Concentrate			
	Assays g/t		% Distribution		Assays g/t		% Distribution	
	Pt	Pd	Pt	Pd	Pt	Pd	Pt	Pd
Xanthate	35.5	32.0	37.5	46.6	15.3	9.7	50.4	49.8
Xanthate+dithiophosphate	38.6	34.4	50.3	49.6	10.9	9.6	69.1	68.3
Xanthate + KZ-22	44.6	40.3	70.1	69.6	15.8	10.9	78.8	75.6
KZ-22	50.6	46.7	75.5	73.1	14.8	10.3	85.5	82.4

## INTRODUCTION OF NEW TECHNOLOGY TO OPERATING PLANTS

### Introduction

Novel reagents and alternative flowsheet configurations generated by SGS Lakefield Research in over 40 operating plants world wide in the last 10 years, resulting in a significant improvement in plant metallurgy, as well as a reduction in operating costs.

A powerful **parametric** mathematical model, developed as a result of 40 years of in-plant studies and pilot plant test programs, is used to identify operating problems and to develop scale-up parameters for transfer of new technology into operating plants. To generate data for model analyses, a three-step method is used:

### Three Step Method

#### Step 1. Plant auditing, surveys and data analyses.

A senior SGS Lakefield mineral processing engineer conducts an in-plant audit in which the performance of each unit operation is carefully analysed. The controllable and uncontrollable operating parameters are grouped, and their effects on plant metallurgy are determined. Historical plant data might also be reviewed. These data are then analysed using the parametric model, and possible operating problems and improvements identified in a test program outline.

#### Step 2. Laboratory test work on mill feed

The details of a test program generated in Step 1 are assessed and the applicability of new technology to a particular ore is evaluated. In addition, scale-up parameters for introducing the new technology to an operating plant are generated.

#### Step 3. Technology transfer

Technology transfer. The plant is adapted and converted, where necessary, to accept the transfer of the new technology. The new technology is introduced to the plant over a highly-supervised commissioning period.

### References

1. Bulatovic, Srdj, Minerals Engineering, V16 (2003), p 931-939