

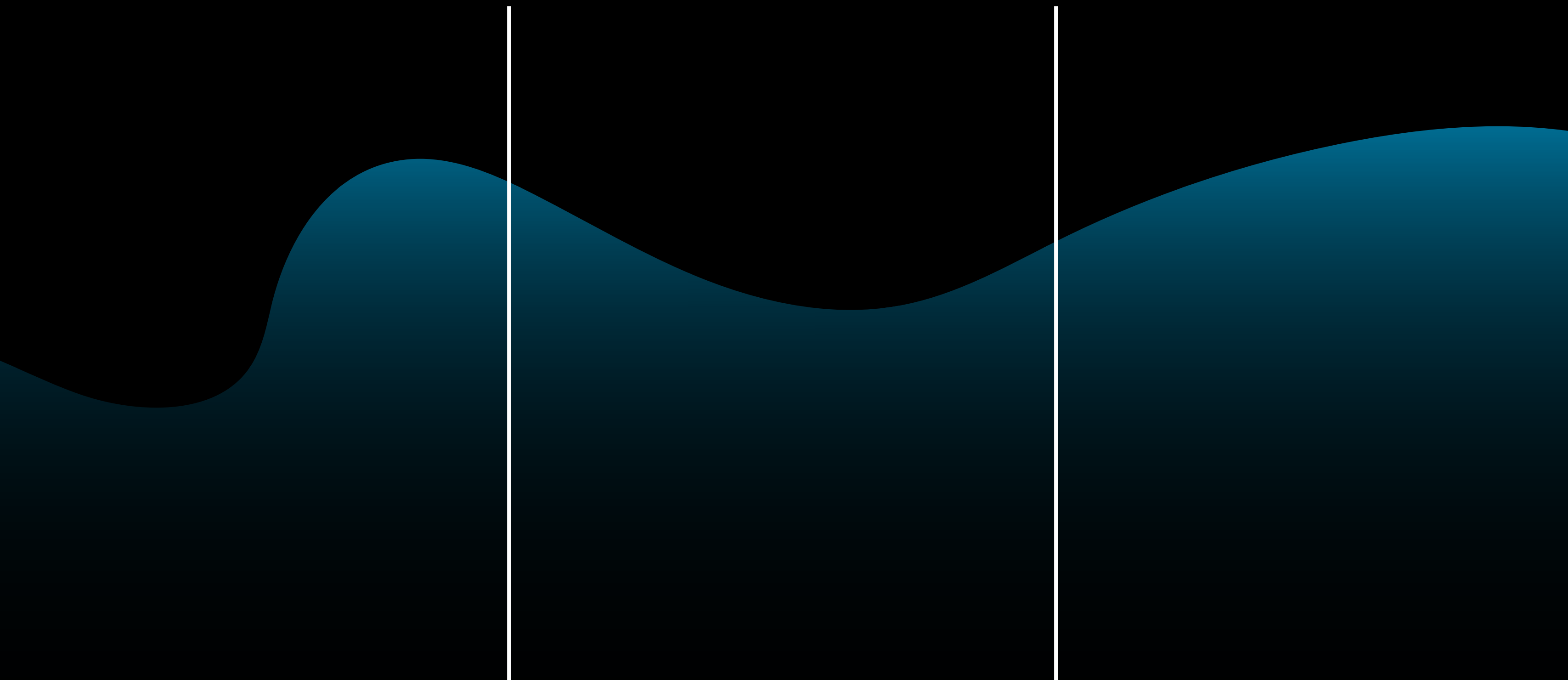


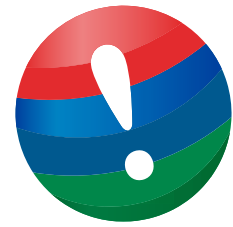
GOLDORE
TOMORROW'S TECHNOLOGY TODAY

MACH REACTOR™
INNOVATION



Contents Page





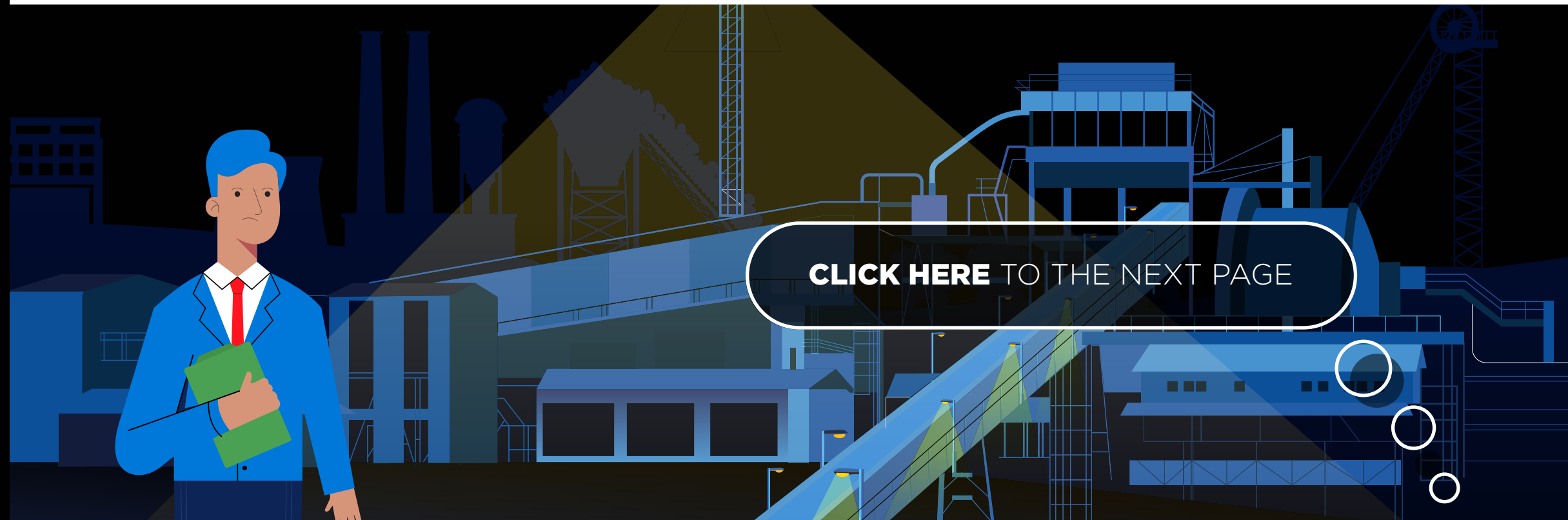
SECTION 1

What are the problems metallurgical operations are facing?

*Is your metallurgical operation **struggling** with machinery that just doesn't last?
Is your metallurgical operation **having problems** with flotation and leaching?*

Well, there is most certainly light at the end of the underground tunnel, with the gold waiting to be extracted!

At Gold Ore (Pty) Ltd. we've helped metallurgical operations around the world by incorporating the **innovative MACH REACTOR™ technology** into their circuits to improve the extraction of minerals in the most effective way possible.





SECTION 2

Introduction to Gold Ore (Pty) Ltd.

Mission

Our mission statement at Gold Ore (Pty) Ltd. is to **make a change**. We are here to **disrupt the metallurgical industry** and introduce a new way of thinking and doing, with the objective of positively impacting the metallurgical landscape in a sustainable and lasting manner.



Gold Ore (Pty) Ltd., was founded by Adrian Singh in 2012.

Having studied both science and music, Adrian can be described as equal parts creative and scientific.

Self-proclaimed as being “a little bit crazy”, he harnesses this side of his personality to do what he does best – **invent!** Adrian started his career in 1989 and has since gained varied experience in research, design and operations.

His entrepreneurial journey started at an early age, when it became clear that the corporate world wasn't for him. Since then, his passion, drive and constant strive for perfection has led him to great success. Adrian is not short of ideas and ambition, with already having several patents to his name. One of the latest patents being the worldwide patent for the **MACH REACTOR™**. He lives by the notion that he can always do something better and has a “anything is possible” attitude.

Gold Ore, founded in 2012, is here to disrupt the metallurgical industry. We work in a world where quirky creativity is combined with hard science, creating unique and unparalleled solutions never seen before. We strive to achieve a paradigm shift in mindsets to uplift the industry and reshape the future.

“As the CEO and founder of Gold Ore (Pty) Ltd., I am really passionate about what I do. I am here to help you maximise your profits and improve your metallurgical operation.” – Adrian Singh

Founder and CEO

What is true success to me?

It's that feeling at the end of the day, knowing that you were able to positively affect the lives of those around you. I do this by using my intuition and deep insight into natural phenomena combined with a slightly crazy mentality. After all, the only people that can change the world are those who are crazy enough to think that they can!

My invention, the **MACH REACTOR™**, has the power to reshape the metallurgical landscape and catalyse positive change for a better future.



SECTION 2

Introduction to Gold Ore (Pty) Ltd.

How was the MACH REACTOR™ invented?

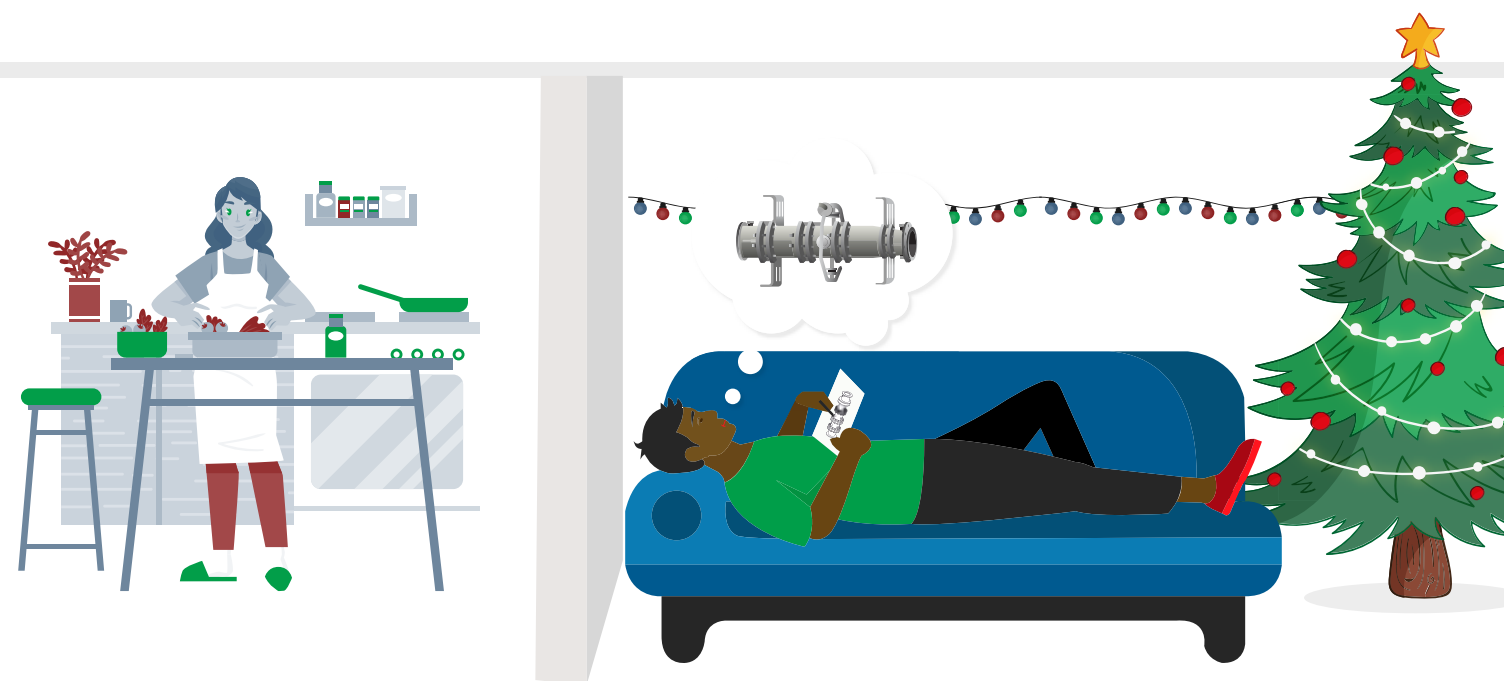
I am sometimes in awe that this incredible invention which was something that came to me on Christmas day all those years ago, while I was lying on the couch after Christmas lunch and doodling on a paper serviette, could stand up to such intense technical scrutiny and emerge victorious against some long-standing stalwarts of the industry!

“That deep level of intuition could only have come from a higher power...I feel blessed, grateful, and determined to use this technology to touch lives and change the scientific landscape to bring positive change to the world.”

It's been a number of years in the making and a fair chunk of cashflow down the line, but what an amazing rollercoaster ride!

Intellectual property law was a whole fascinating new world for me and I am deeply grateful to the beautiful minds that helped to steer and shape the MACH patent offering into what it is today.

Debating with the various patent offices both in the written word and via oral interviews, and studying the prior art that was sometimes naively put forward, was both an immensely challenging and sometimes amusing experience. Whereas it has been a joyful journey proving the novelty and patentability of the MACH over the years.





SECTION 3

Overview of the MACH REACTOR™ - What is it?

*The way I think when it comes to science - **There are no rules!***

The MACH REACTOR™ is a hyper shear mass transfer reactor harnessing the exceptional power of controlled cavitation to generate pico-bubbles to greatly enhance the mass transfer of gas into solution and create a highly charged environment promoting chemical reactions that would otherwise not be possible.

The revolutionary MACH REACTOR™ aids in the extraction of minerals in the most efficient way possible, helping you to achieve and surpass production targets and improve profit margins.





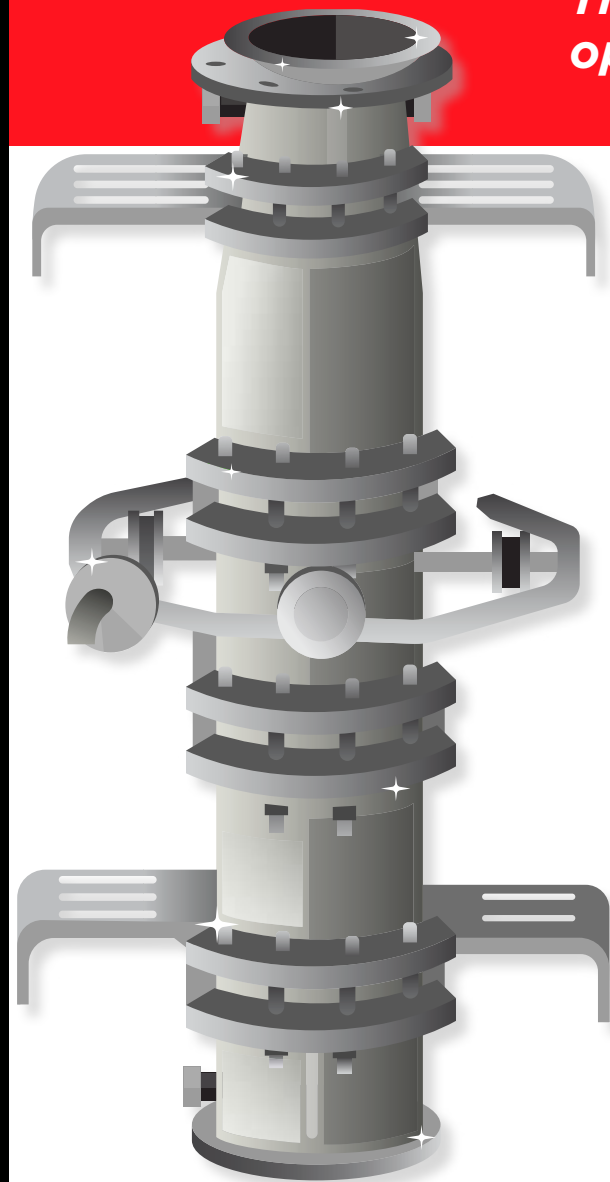
SECTION 3

Overview of the MACH REACTOR™ - What is it?

03

What is the MACH?

The MACH REACTOR™ will do wonders for your metallurgical operation. Take the first step to reap all of these incredible benefits:



1.

For **leaching operations**, the benefits include:

Improved recovery

Faster leach kinetics

Reduced reagent consumption

2.

For **flotation operations**, the benefits include:

Higher recovery

Higher grade

Lower mass pull

Lower gangue entrainment

Flotation Euphoria

3.

The benefits of the **MACH REACTOR™** itself include:

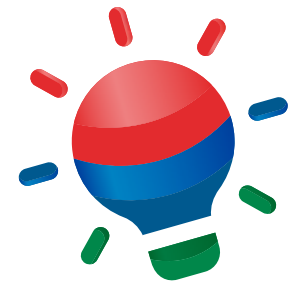
No moving parts

Highest quality ceramic lining of high wear sections

On-corrosive and chemical resistant body

A low power draw

Zero maintenance, and the reactor life is equivalent to the project life



SECTION 3

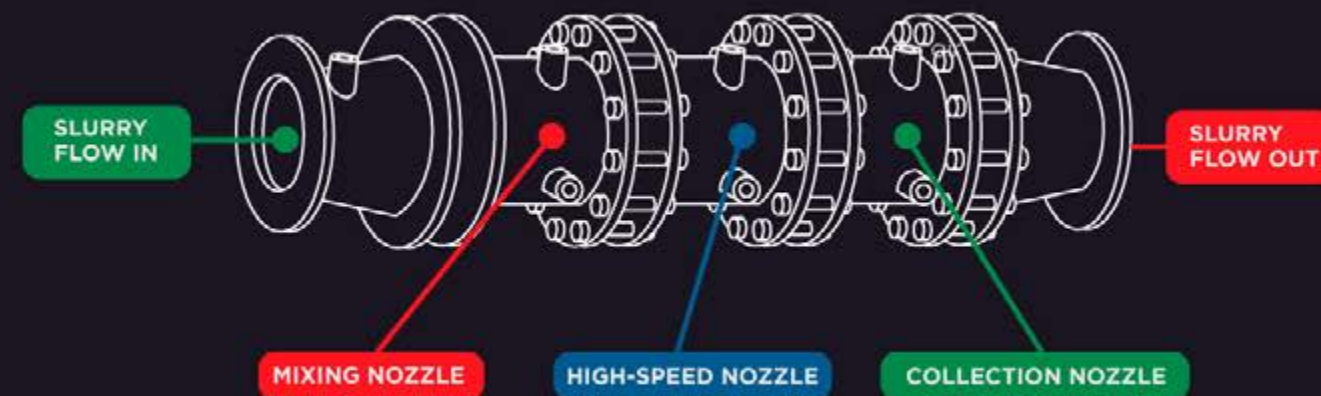
Mach Design Basics

03

What is the MACH?

*The MACH REACTOR™ can be applied across a range of commodities, from **environmental remediation** through to **metal extraction** in hydro-metallurgical plants.*

It is here to stay and will bring nothing but **amazing benefits and improvements** to your operation. The mixing nozzle, high-speed nozzle, and collection nozzle work consecutively after each other in a multi-staged arrangement to maximize mixing, cavitation, and shear for maximum metallurgical effect.



The MACH REACTOR™ finds popular application in **gold leaching circuits** for pre-oxidation and boosted leach of gold ore. Special applications may be found for semi-refractory to refractory gold ores.

The technology may also be applied to **conditioning and external aeration in a flotation application**, where we achieve better selectivity and recovery at lower mass pulls – flotation euphoria! These will be explained more in each specific section later in the brochure.



SECTION 3

How Did The MACH REACTOR™ Get Its Name?

*Cavitation is not something normally applied within the metallurgical industry. Gold Ore has found a way to **harness this powerful energy** and put it to good work within metallurgical processes.*

The German physicist; Ernst Mach, first conducted an experiment in 1887 where he photographed an object moving faster than the speed of sound.

'MACH' is defined as **the ratio of the speed of a body to the speed of sound in the surrounding medium.**

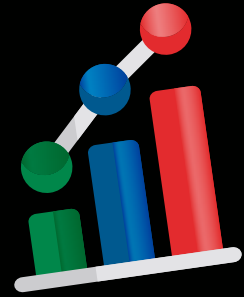
It is often used with a numeral (such as Mach 1, Mach 2, etc.) to indicate the speed of sound, twice the speed of sound, etc.

In the MACH REACTOR™, both the speed of the bubbly 3 phase mixture flowing through the venturis as well as the speed of the re-entrant jets that split imploding cavitating bubbles, approach and exceed the speed of sound. **Hence the name 'MACH REACTOR™'.**



The MACH REACTOR™ finds popular application in gold leaching circuits for **pre-oxidation and boosted leach of gold ore.** Special applications may be found for semi-refractory to refractory gold ores.

The technology may also be applied to conditioning and external aeration in a flotation application, where we achieve better selectivity and recovery at lower mass pulls - **flotation euphoria!** These will be explained more in each specific section within the brochure.



SECTION 4

How will the MACH REACTOR™ benefit me and my operation?

04

Benefits

The MACH challenges a lot of conventional metallurgical rules
– *so brace yourself for a fun ride to success!*



Self-aspirating

The MACH REACTOR™ is the only **high shear/cavitating device** currently on the market that is **completely self-aspirating**.

The self-aspiration aspect, combined with the comparatively lower power draw, makes it particularly suitable to projects where power costs are high, or power is self-generated.



Cavitation

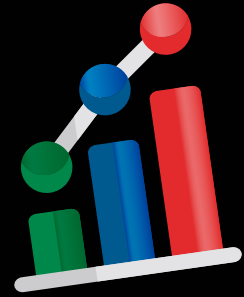
Gold Ore has found a way to harness the powerful energy of cavitation and use it for success in metal extraction.

Let's put the MACH into perspective when one considers gas injection devices in the industry. Of lowest efficiency are lances and spargers which have little to no energy input.

Shear devices have moderate energy input and are slightly more efficient compared to lances and spargers.

At the pinnacle of highest efficiency are cavitation devices where turbulent kinetic energy dissipation rates are at their highest, enhanced by the extreme energy release of the cavitation process, and pico-bubble nucleation on hydrophobic surfaces as generated within the patented and proprietary MACH REACTOR™.

The speed of sound gas velocities combined with the extremely small pico-bubbles and extreme energy release within the MACH work together to yield order of magnitude improvements in gas-liquid mass transfer coefficients (kLa) when compared to less efficient gas injection devices.



SECTION 4

How will the MACH REACTOR™ benefit me and my operation?

04

Benefits

Need to boost your Leach? We've got you covered! The MACH REACTOR™ accelerates leach kinetics while also improving leach recovery.

Leaching

The extraordinary ability of the MACH REACTOR™ is used to **accelerate leach kinetics as well as overall recovery for gold leach operations.**

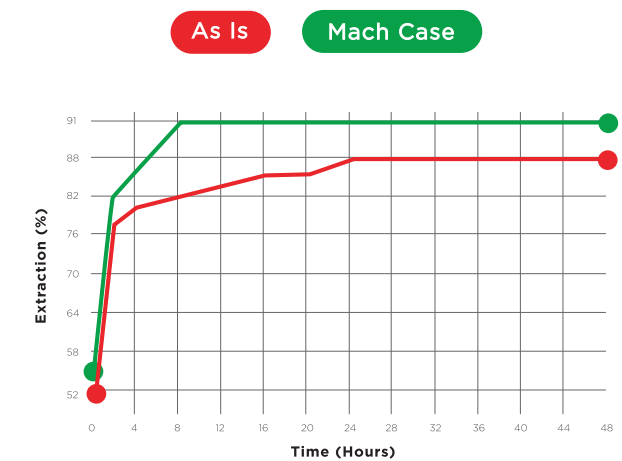
The primary consumers of cyanide in a typical gold plant are soluble iron and sulphide. Preoxidation with a MACH REACTOR™ oxidises ferrous to ferric and precipitates ferric hydroxide and oxyhydroxides.

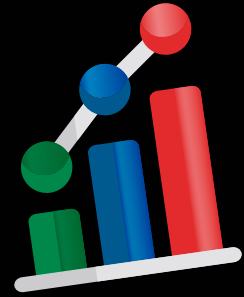
A ferric hydroxide layer is also formed on the surface of the mineral to prevent further leaching of deleterious cyanide consumers.

Preoxidation may also be followed by a MACH boosted leach stage where cyanide is also added to the MACH REACTOR™ to vastly reduce boundary layers and improve diffusion and so further accelerate leach kinetics. Leach residence times may be reduced by as much as 50 to 70% by the use of the MACH REACTOR™.

Faster leach kinetics with the MACH is almost guaranteed and is almost always seen with testwork and upon plant installation. What is more difficult to achieve is the improved overall recovery and this is largely dependent on how sensitive the mineralogy is to MACH treatment. Leach recovery improvements of between 2 and 10% can be realised on certain ore types.

BOOST YOUR LEACH





SECTION 4

How will the MACH REACTOR™ benefit me and my operation?

Applications for Gold Leaching

There are a number of different ways that the MACH can be applied to your gold operation in order to best suit the needs and requirements of your circuit. At Gold Ore, we can custom build the MACH to suit your flow requirements or you can select from a range of models that we have available off the shelf.



Oxidation and leaching of refractory gold concentrates



Pre-oxidation and leaching of preg-robbing carbonaceous gold ores



Pre-oxidation and leaching of free milling gold ores with kinetic benefit



Cyanide destruction and arsenic remediation



Water treatment

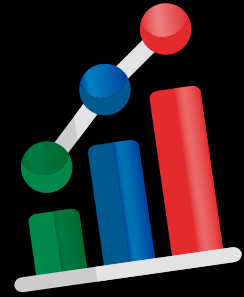
Improved Flotation

Need to enhance your flotation grade and recovery?

Through the effective flotation of well liberated and high-grade fines with the MACH REACTOR™, we are able to provide a completely new and steepened grade recovery curve where both grade and recovery is improved, resulting in **flotation euphoria!**

Higher grade and lower mass combined with higher recovery, as provided by the MACH, is something not usually seen in the flotation industry.

Flotation has been at the heart of the mineral processing industry for over 100 years, addressing the 'sulphide' problem of the early 1900s, and continues to provide one of the most important tools in mineral separation today.



SECTION 4

How will the MACH REACTOR™ benefit me and my operation?

04

Benefits

Improved Flotation

The realization of the effect of a minerals hydrophobicity on flotation all those years ago has allowed us to treat oxides, sulphides and carbonates, coals and industrial minerals economically, and will continue to do so in the future.

The MACH REACTOR™ makes this process just that much more efficient.

- This graph depicts the typical trend for particle size recovery in a conventional flotation system.
- The MACH REACTOR™ targets valuable fines and particles with tarnished surfaces to improve both their kinetics and recovery.

The concept of the MACH REACTOR™ application to flotation is similar to the reactor-separator principle of pneumatic flotation - the MACH is the “reactor” where flotation contact takes place and the conventional flotation cell is the “separator” where froth is separated from slime.

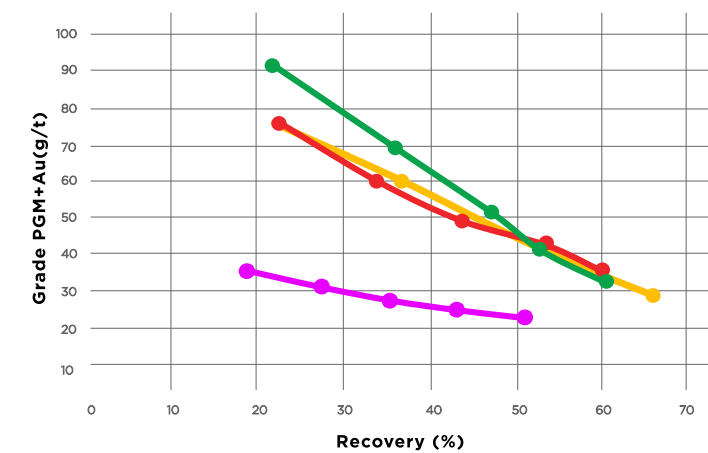
The MACH REACTOR™ may be installed on recirculation on a conditioning tank ahead of conventional flotation, in-line feeding into the first flotation cell and on recirculation on flotation cells and columns.

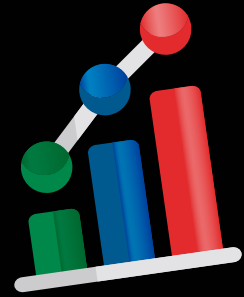
This versatility and flexibility that decouples the MACH REACTOR™ from flotation cells and allows the client to choose the flotation machine best suited to his operation.

The MACH brings cutting edge technology to the tried and trusted conventional flotation cell, allowing the operator to exploit the benefits of next-generation technology while still using conventional flotation cells as the backbone of the plant. So much easier to get buy-in from the board!

FLOTATION EUPHORIA!

As Is 5 Pass 10 Pass 15 Pass





SECTION 4

How will the MACH REACTOR™ benefit me and my operation?

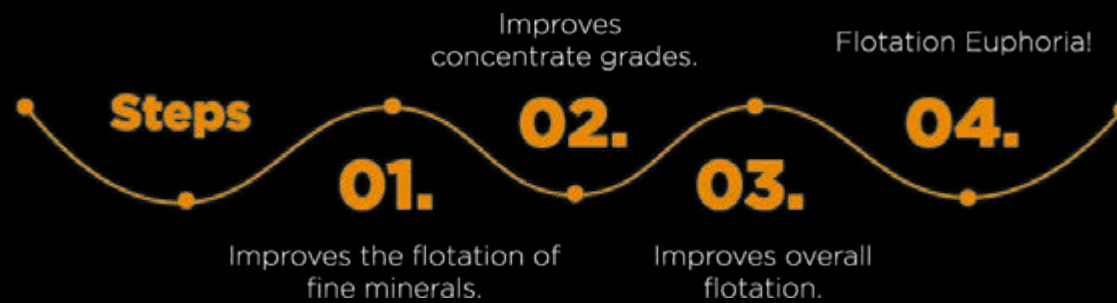
04

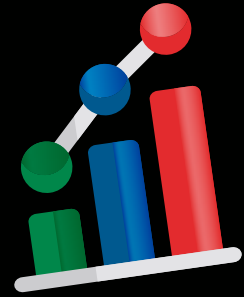
Benefits

Improved Flotation

Here are the following steps that the advanced MACH REACTOR™ takes in order to enhance flotation.

Firstly, it improves the flotation of the fine minerals, it then improves the concentrate grades drastically which then results in an overall improvement in flotation, this continues until Flotation Euphoria is reached!





SECTION 4

How will the MACH REACTOR™ benefit me and my operation?

04

Benefits

Research graph (flotation response of your UG2 ore)

The MACH REACTOR™ has great potential to significantly improve the **flotation response of your UG2 ore**.

This graph depicts the results of research comparing the base case conventional flotation to the MACH case with 3, 9, and 10 passes. A clear trend can be seen with reduced chrome recovered to concentrate with increasing MACH passes.

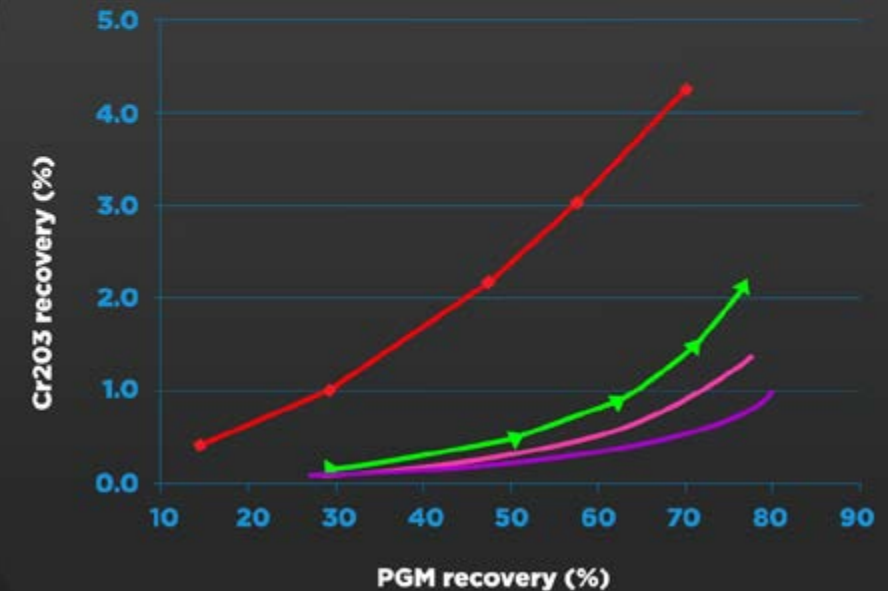
PGM recovery either remains unchanged or shows a slight improvement. This amazing and desirable reduction of chrome in the concentrate is fortuitous and may be explained by the removal of talc coatings from chrome surfaces and potential froth modification with the MACH resulting in better drainage.

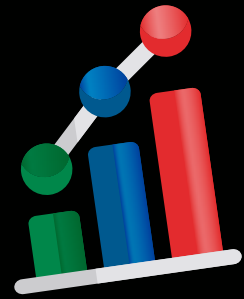
MACH installations ahead of both roughing and cleaning circuits are recommended to take full advantage of this effect.

RESEARCH

UG2 ROM CONTAINING 18% CHROMITE

Base Case MACH 3 Passes MACH 9 Passes MACH 10 Passes





SECTION 4

How will the MACH REACTOR™ benefit me and my operation?

04

Benefits

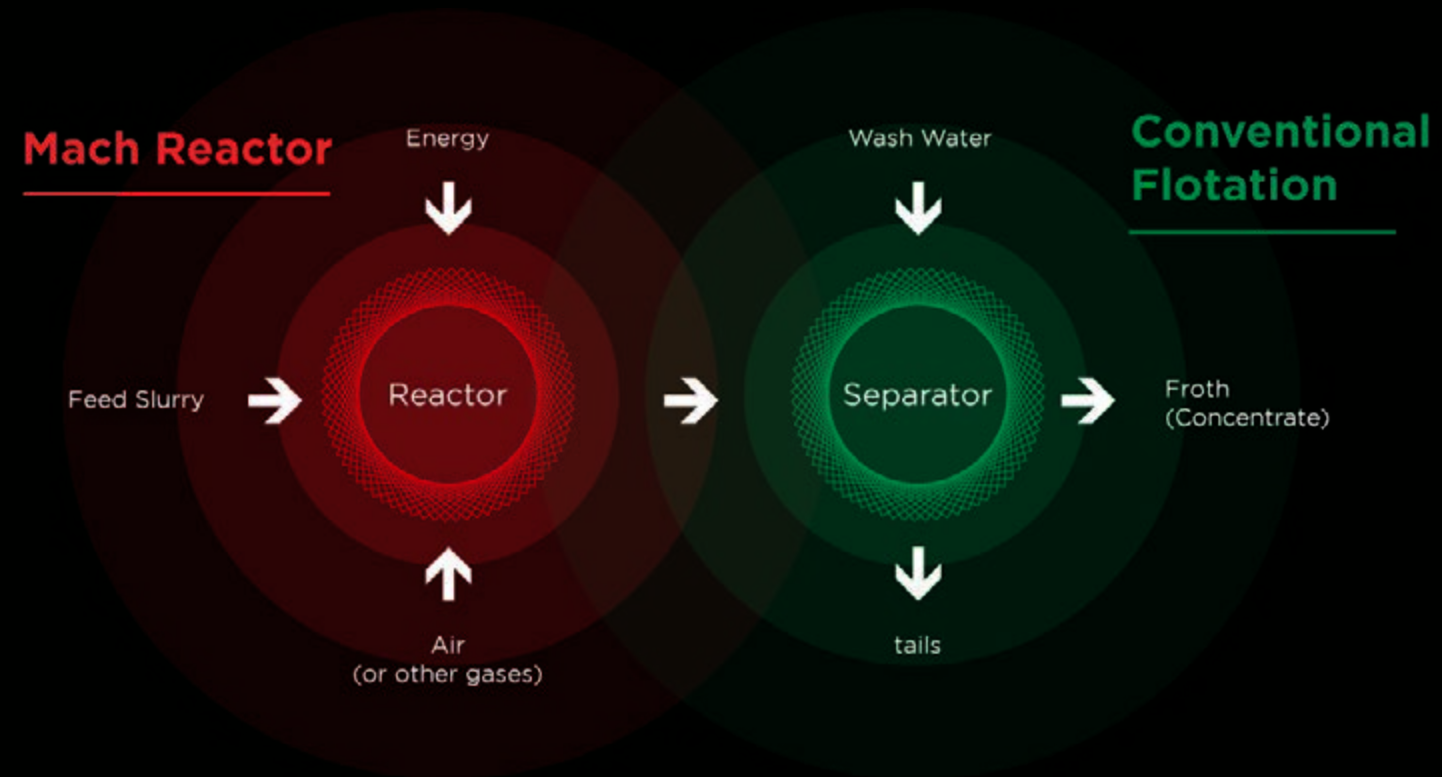
Successful flotation vs. conventional flotation

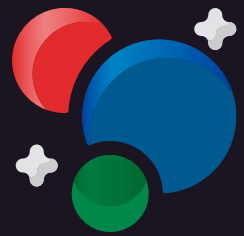
The bulk of the losses in PGM plant flotation tailings in South Africa lies in the minus 25-micron fraction.

Valuable fines are typically lost to flotation tailings owing to the low mass and inertia of these particles causing them to become entrapped in the streamlines around the bubbles with no collision and attachment taking place.

When this material is subjected to MACH preconditioning ahead of conventional flotation, tiny pico-bubbles are generated on the surfaces of the valuable fines as they pass through the cavitation venturis in the MACH.

The pico-bubble attached valuable fines then aggregate together to form a pseudo optimum sized particle for flotation to enable collision and attachment to flotation sized bubbles.



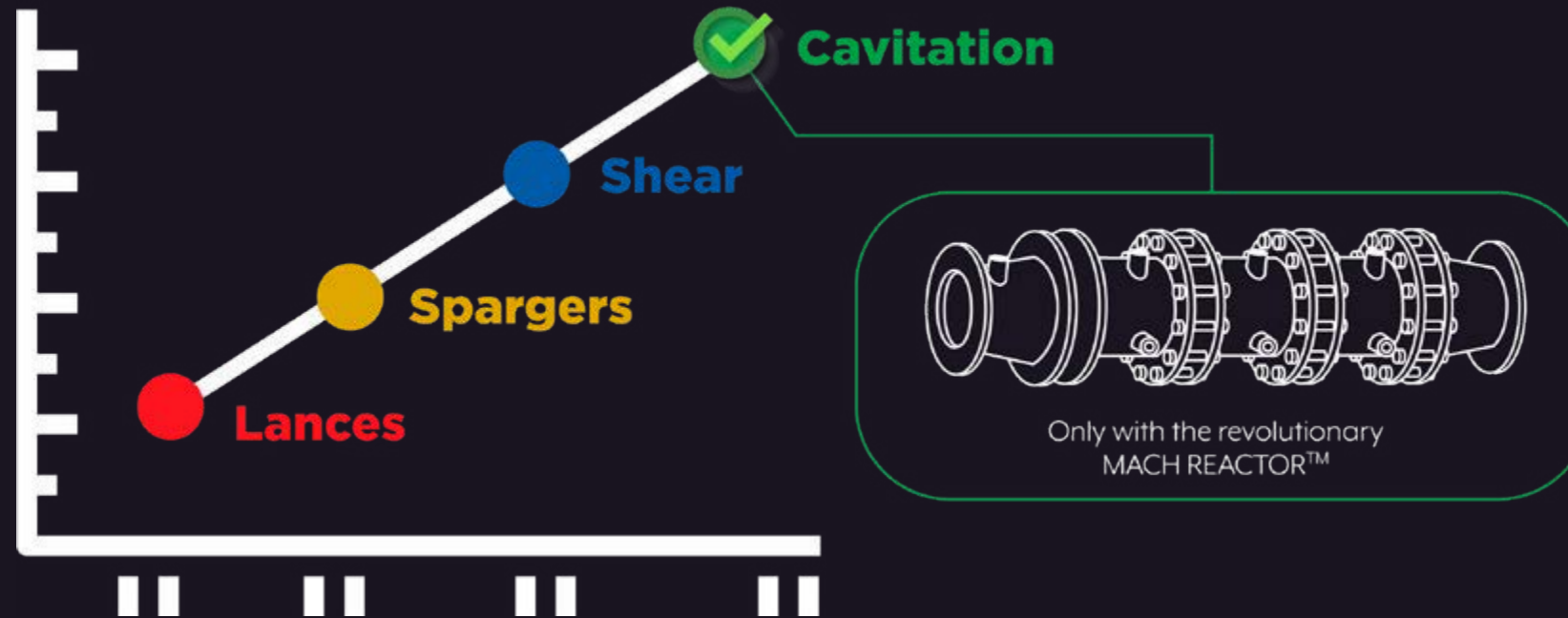


SECTION 5

What is the difference between cavitation and shear?

05

Cavitation VS. Shear?



Cavitation vs. Shear

Let's put the MACH into perspective when one considers gas injection devices in the industry. Of lowest efficiency are **lances and spargers** which have little to no energy input.

Shear devices have moderate energy input and are slightly more efficient compared to lances and spargers.

At the pinnacle of highest efficiency are cavitation devices where turbulent kinetic energy dissipation rates are at their highest, enhanced by the extreme energy release of the cavitation process, and pico-bubble nucleation on hydrophobic surfaces as generated within the patented and proprietary **MACH REACTOR™**.

The speed of sound gas velocities combined with the extremely small pico-bubbles and extreme energy release within the MACH work together to yield order of magnitude improvements in gas-liquid mass transfer coefficients (kLa) when compared to less efficient gas injection devices.



SECTION 6

Cost Benefit Analysis

Leaching

Flotation

Recovery Improvement	2%
Incremental Monthly Revenue	R7.4 million
MACH Monthly Rental	R200 000
Incremental Electricity Cost	R0.7 million
Incremental Profit	R6.5 million
Installation Cost	R2 million
Payback on Installation	2 weeks

Recovery Improvement	6%
Incremental Monthly Revenue	R5 million
MACH Monthly Rental	R300 000
Incremental Electricity Cost	R0.9 million
Incremental Profit	R3.8 million
Installation Cost	R6 million
Payback on Installation	1.6 months



SECTION 7

Hydrodynamic cavitation and the MACH

Hydrodynamic cavitation is the process of accelerating a liquid through a constriction such as a venturi until the instantaneous pressure drops to below water vapor pressure and causes tiny cavities to nucleate on hydrophobic particles in the liquid.

This process is otherwise known as **'cold boiling'**.

1

These cavities may be ventilated with a gas to be dissolved and are finely disseminated when the cavities collapse in higher pressure regions and form pico-, nano- and micro-bubbles with a tremendous energy release.

2

This energy is used positively within the MACH REACTOR™ to clean particle surfaces, break particles for better liberation, emulsify reagents, and dissolve gas.

3

This technology is completely different from the traditionally and widely known principles with unparalleled levels of efficiency.



SECTION 7

Hydrodynamic cavitation and the MACH

Cavitation is not something usually applied within the metallurgical industry, but Gold Ore has found a way to harness this powerful energy and use it for greatness!

07

Hydrodynamic cavitation



The imploding cavitating bubbles in the venturis of the MACH REACTOR™ constitute the 'heart of the MACH REACTOR™'.



These imploding bubbles generate extreme temperatures of up to 5 500°C and pressures of around 1 000 atmospheres.



This creates a highly reactive environment for mass transfer and chemical reaction allowing certain reactions to take place that would otherwise not be possible. The MACH REACTOR™ uses this power of cavitation to drastically improve your metallurgical processes.



SECTION 7

Cavitation in a Venturi

This causes cavitation bubbles to nucleate on hydrophobic particles in the liquid. These cavities may be ventilated with a gas to be dissolved at this point.

As the cavitation bubbles travel down the venturi to a point of higher pressure they will implode to release tremendous energy which may be used to:

- * Dissolve gases,
- * Improve diffusion,
- * Emulsify reagents,
- * Clean particle surfaces,
- * Break particles,
- * Accelerate a chemical reaction such as gold leaching, and
- * Attach pico-bubbles onto hydrophobic particle surfaces for improved flotation of fines.

In a venturi or similar linear flow restriction, cavitation occurs when the flow rate attained is sufficient to lower the local pressure within the throat of the device to the saturated vapor pressure of the liquid.

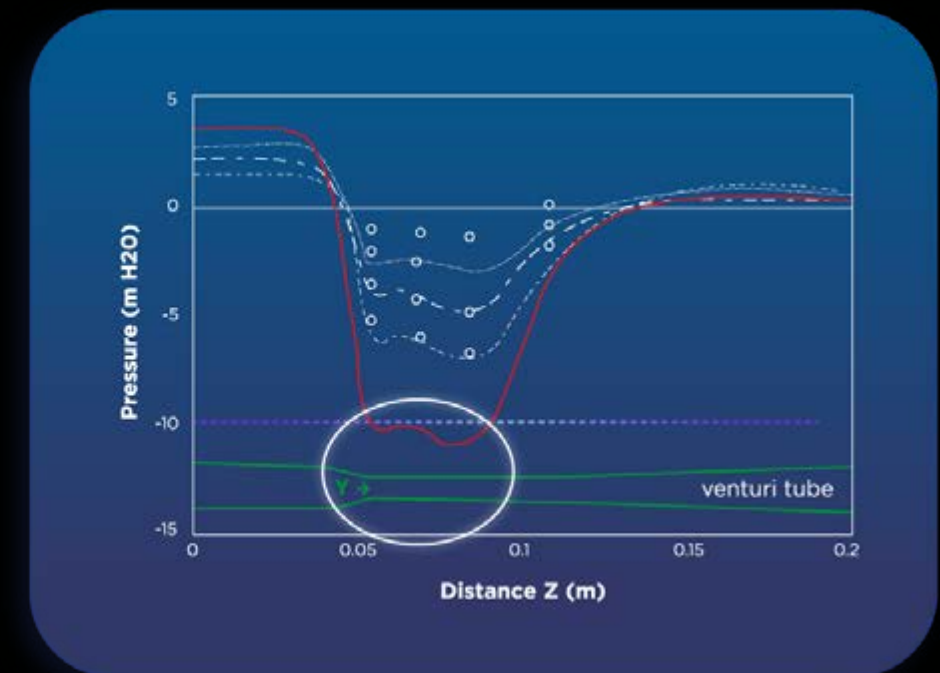
07

Hydrodynamic cavitation

CAVITATION IN A VENTURI

observed cavitation

water vapor pressure





SECTION 7

Mach is not a mill!

The **MACH REACTOR™** harnesses the tremendous energy release from cavitation and directs it positively for mineral beneficiation.

07

Hydrodynamic cavitation

Cavitation, which is usually viewed negatively by the industry for the damage that it causes to pumps and pipelines, is put to good work in the MACH, where it is used to remove passivation layers, clean particle surfaces, and improve diffusion.

Indeed, the effect is so great that it is measurable as particle breakage!

Having said that, the MACH is not designed to be a mill and should be applied to enhance leaching, cyanide destruction, and the flotation of valuable fines.

THE MACH IS NOT A MILL!

~~~~~

**MACH not only about pico bubble nucleation on hydrophobic surfaces it begins with:**

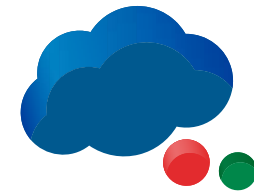
- Removal of passivation and oxidized layers
- Improved liberation



**GOLD DORE**  
TOMORROW'S TECHNOLOGY TODAY

Research - UG2 ROM  
PSDs AFTER MACH

| Sieve (µm) | 10 Pass   | 30 Pass   | 40 Pass   |
|------------|-----------|-----------|-----------|
|            | % Passing | % Passing | % Passing |
| -25        | 37.65     | 43.62     | 60.18     |



# SECTION 8

## Nernst Boundary Layer Theory

---

**Once the chemical conditions for gold leaching have been satisfied** i.e. both cyanide and oxygen are present in solution in excess, then diffusion becomes the rate-limiting step.

---

This is because the gold leach reaction takes place in a heterogeneous medium with gases, solution, and solids involved in the reaction process.

**The boundary layer was first proposed by a scholar called Nernst, in 1904**, who proposed that there was a clean water layer surrounding every particle in a slurry medium. Reactants and products have to diffuse through this layer for a successful reaction to take place.

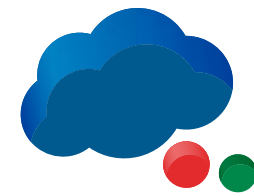
The cavitating conditions within the venturis of the MACH also generate extremely high Reynolds numbers with intense mixing that thins the boundary layer and speeds up diffusion through it.

If there are passivation layers around the particle then these will be cleaned off with the MACH and if the passes are high enough then the MACH can also cause **particle breakage to improve liberation**.

08

Nernst Boundary Layer Theory





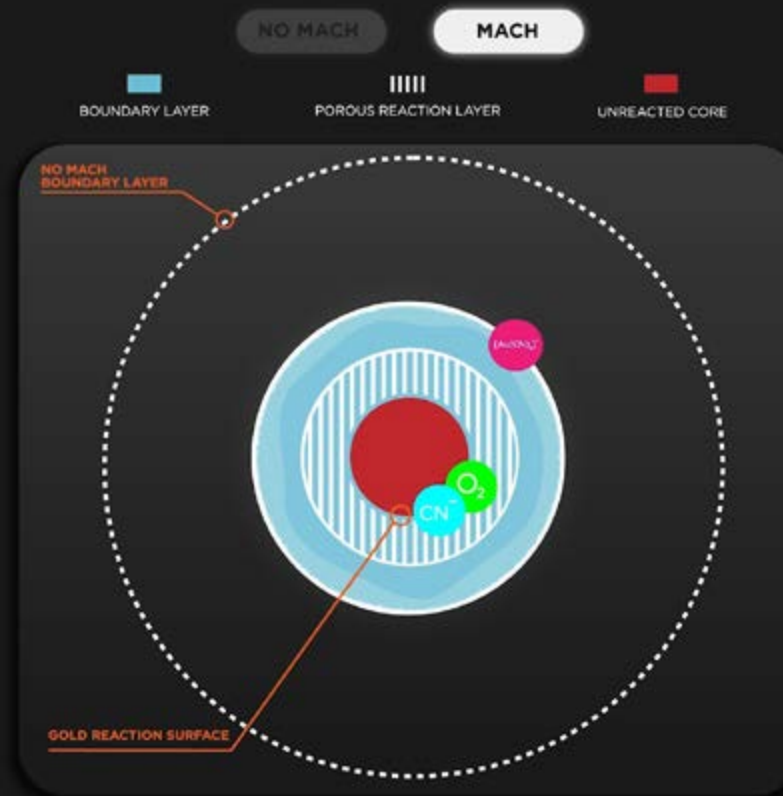
# SECTION 8

## Nernst Boundary Layer Theory

**The Final Frontier:** this animation shows how the revolutionary MACH REACTOR™ accelerates the gold leach reaction by improving diffusion across the Nernst Boundary Layer.

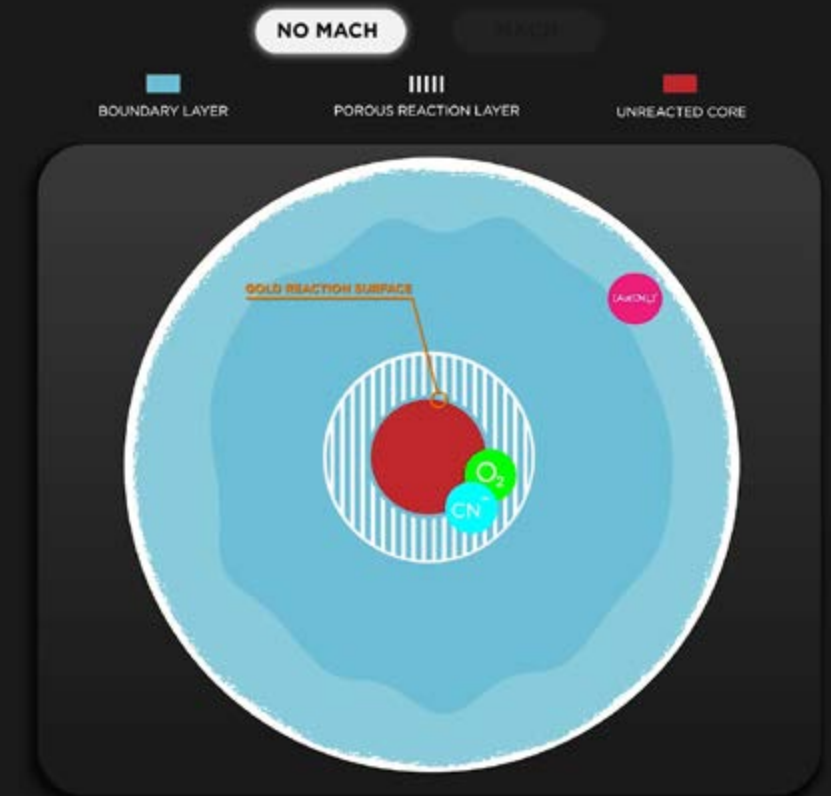
08

### Nernst Boundary Layer Theory

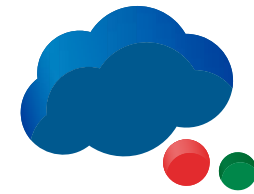


**WITH THE MACH REACTOR™:** the second part of the animation shows how the high shear, cavitation, and intense mixing in the high-speed venturis of the MACH are able to significantly thin down the boundary layer to drastically accelerate the reaction rate by giving the reactants and products a much shorter distance to diffuse through.

**THE NO MACH CASE:** the first part of the animation shows the slow diffusion of oxygen and cyanide across a thick boundary layer, and through the water-soluble, porous reaction layer, to reach the reaction surface and aurocyanide diffusing out through the reaction layer, and across the thick boundary layer to reach the outskirts of the boundary layer. A greater distance to diffuse through equates to slower reaction kinetics.







# SECTION 8

## Nernst Boundary Layer Theory

### Surface cleaning and particle breakage with the MACH!

What sets the MACH apart from the competition is not only its exceptional ability to **reduce boundary layer thickness and accelerate mass transfer for heterogeneous reactions but, more importantly, is its ability to remove surface coatings and improve liberation through particle breakage which often becomes the rate-limiting step once the chemical and diffusion requirements have been met.**

This is facilitated by the **high energy re-entrant jets that split cavitating bubbles** that have already nucleated on valuable mineral surfaces, resulting in cleaning of the mineral surface or grain boundary breakage to improve liberation.

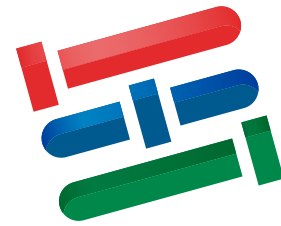
This is important as often leaching reactions become **limited by passivating layers or by incomplete liberation after the milling step.**

The MACH works to maximize the leach rate and extent to sweat your orebody like never before!

08

### Nernst Boundary Layer Theory





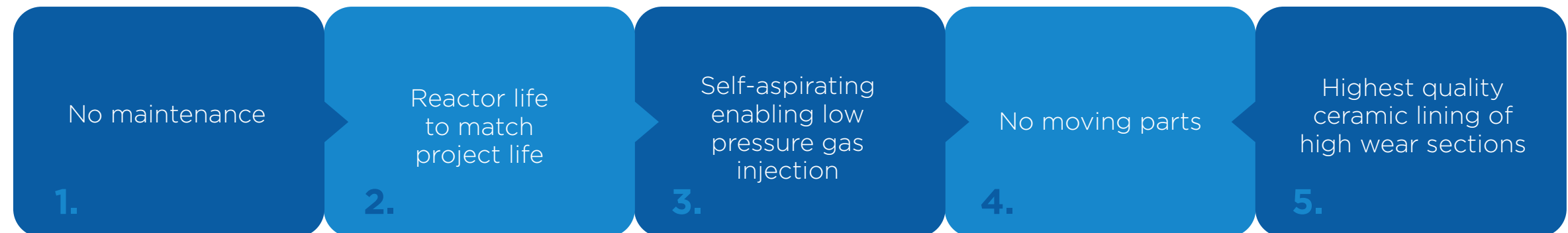
# SECTION 9

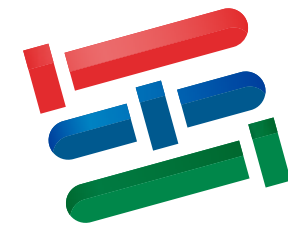
## Design Benefits and Customizability

*There will be no maintenance needed, as the MACH REACTOR™ has no moving parts. The only thing that will show positive movement is your success rate!*

We've had units operating for **7 years without maintenance and can go for an additional 7 years!** Once the MACH is installed, it only takes 1mm of wear for it to settle in and take shape, and after that, it is secured for incredible results and long-lasting durability.

### DESIGN BENEFITS





## SECTION 9

### Design Benefits and Customizability

*It is completely customizable to best suit your operation!*

The MACH is currently the only cavitation device that can accommodate a volumetric flowrate of **3000m<sup>3</sup>/h** through a single unit!

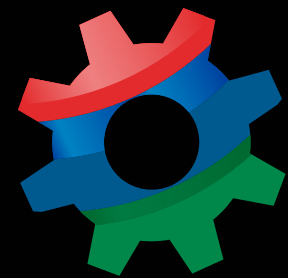
Available MACH REACTOR™ range in size from as small as **0.45m<sup>3</sup>/h** for a laboratory unit to as large as **3000m<sup>3</sup>/h** through a single unit.

When you order your very own MACH for your metallurgical operation, you are able to **customize the capacity, as well as choose from a range of different materials for it to be manufactured in, to ensure the best durability and optimal quality.**

The MACH can be manufactured in combinations of **ceramic, mild steel, stainless steel, rubber, or plastic.** Not only is the material customizable, but the capacity can be customized to any size needed too. This is the competitive edge provided by having the inventor still actively involved with the company!

This will ensure the best results for your specific processes and operation. The MACH will be positioned to feel perfectly at home and do its ultimate best to yield incredible benefits for your circuit.



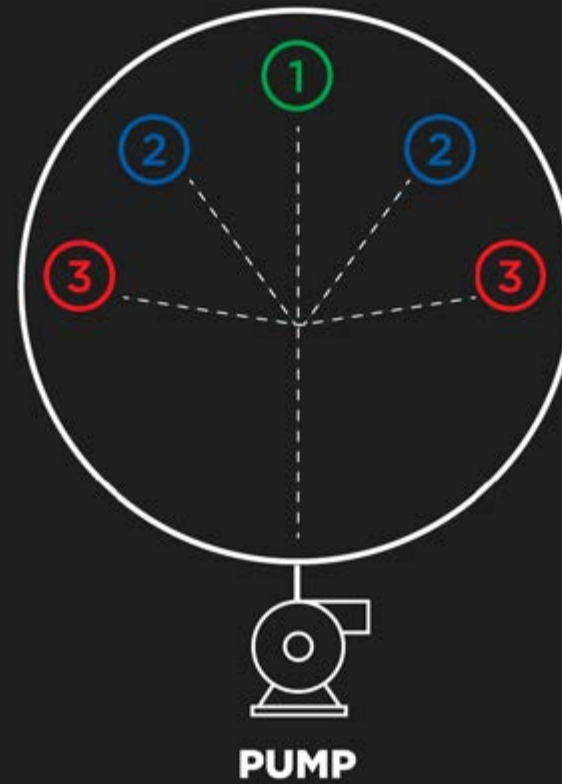


# SECTION 10

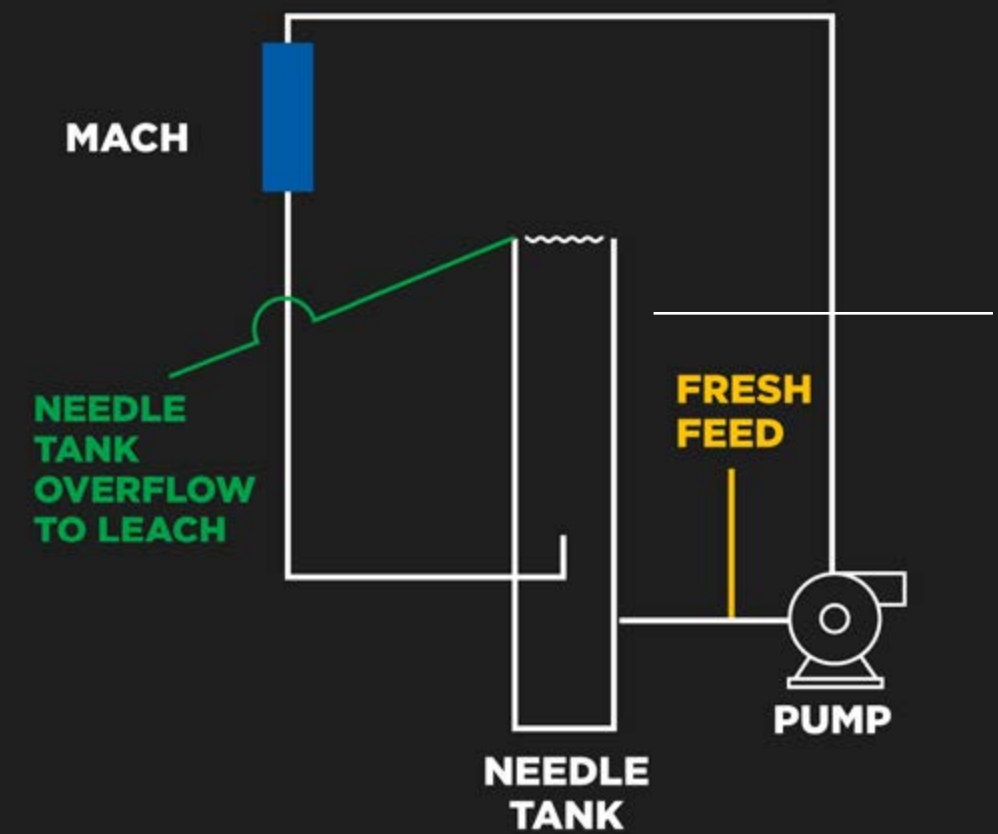
## Different ways to install the MACH

### LEACH TANK (TOP VIEW)

1, 2 AND 3 IS THE DIFFERENT OPTIONS OF MACH POSITIONING  
(IN ORDER OF PREFERENCE - DIRECTLY OPPOSITE THE PUMP SECTION IS MOST PREFERRED)



### NEEDLE TANK SCHEMATIC (SIDE VIEW)



The MACH REACTOR™ is particularly well suited to pre-oxidation and boosted leach applications in gold plants.

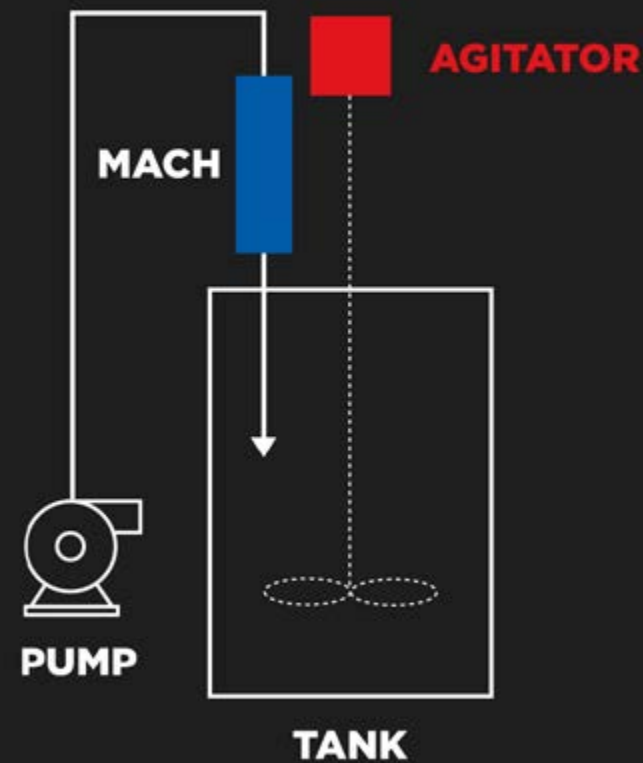
MACH REACTOR™ technology also finds application in the proprietary:  
**Gold Ore Hexate™ Refractory Gold Process** | **Gold Ore Hybrid™ Detox**



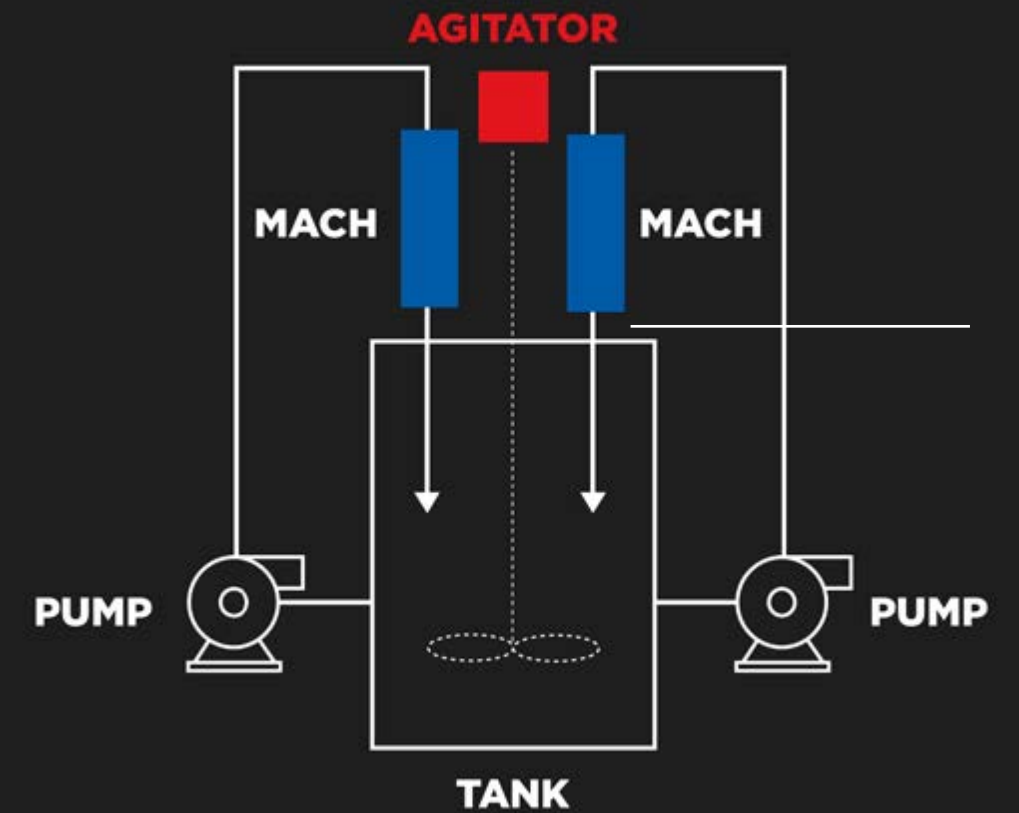
# SECTION 10

## Different ways to install the MACH

### IN-LINE INSTALLATION (SIDE VIEW)



### TANK RECIRCULATION (SIDE VIEW)



The MACH REACTOR™ is particularly well suited to pre-oxidation and boosted leach applications in gold plants.

MACH REACTOR™ technology also finds application in the proprietary:  
**Gold Ore Hexate™ Refractory Gold Process** | **Gold Ore Hybrid™ Detox**



# SECTION 11

## International Success Stories

---



*We are currently operating MACH REACTORS™ in SA, Ghana, Khazakstan, Russia, Zimbabwe, America and Australia and we cannot wait to bring them to your metallurgical operation!*



# SECTION 11

## Ghana

---

*Drastic improvement seen in their process and metallurgical operation with regards to both **leach kinetics and recovery** on their flotation concentrate.*

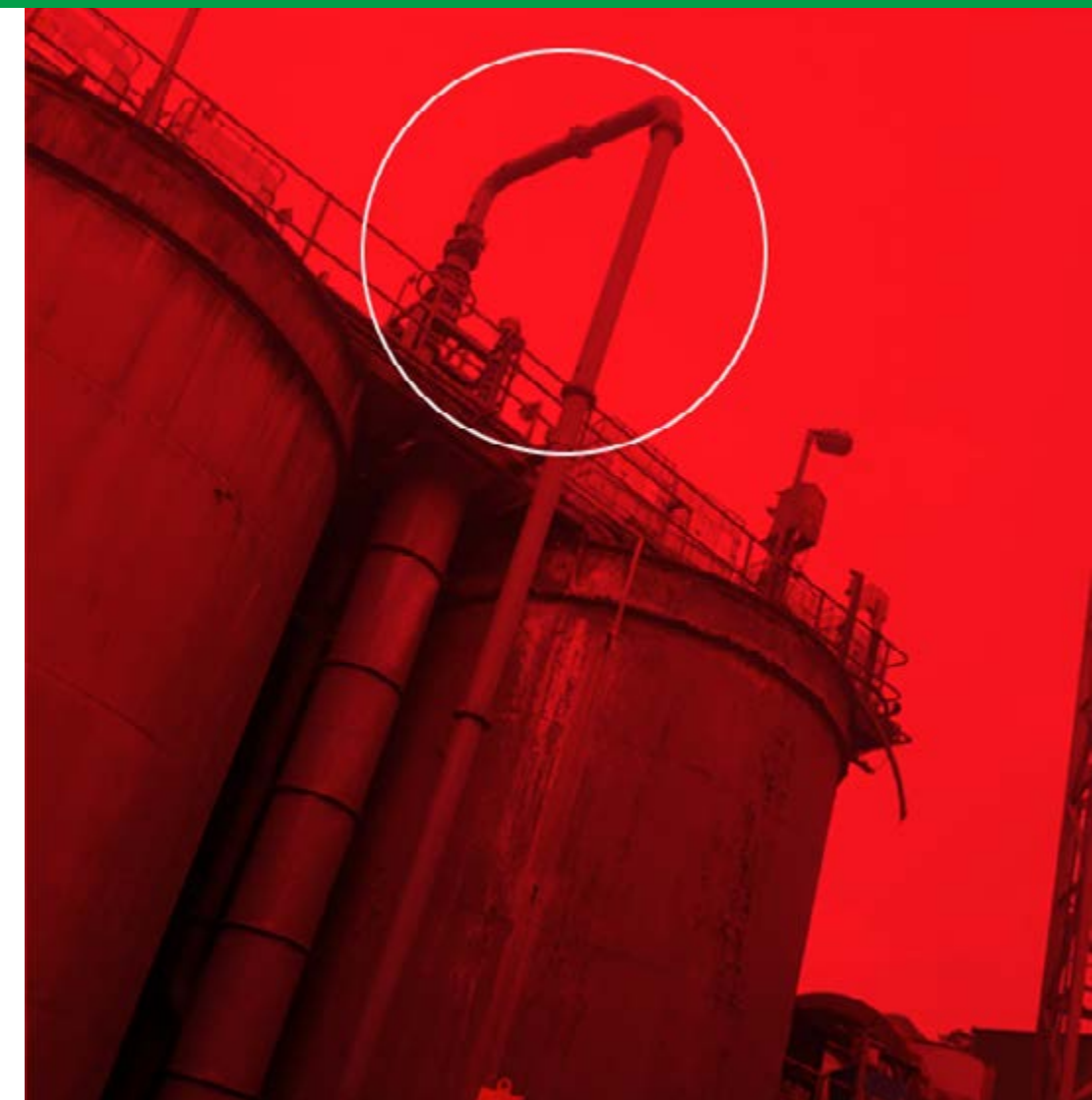
**This installation of the MACH REACTOR™ was done at a gold mine in Ghana** and has shown drastic improvement in their process and metallurgical operation with regards to both leach kinetics and recovery on their flotation concentrate.

This was quite a unique installation of the MACH on recirculation on a pipe column ahead of a CIL plant, owing to preg-robbing characteristics of the ore.

---

**20ff 300m<sup>3</sup>/h MACH REACTORS™** were installed in the leach tank (together with cyanide) ahead of the absorption circuit, which enabled the plant's throughput to increase by 44% without the installation of additional leach tanks.

A leach recovery improvement of 2% on average in the 24 months of operation was also realised.





## SECTION 11

### Kazakhstan

---

*This combination of **high performance, exceptional durability, and incredible ease of operation** is the differentiator that sets the MACH apart from other gas injection devices.*

**In Kazakhstan,** 60ff 2000m<sup>3</sup>/h MACH REACTORS™ were installed in the oxidation and leaching circuit of an operation treating a semi refractory ore body.

This multiple pass installation of the MACH showed significant leach recovery improvements and has lasted over four years without any significant wear to the **MACH REACTORS™**.

---

This is mainly due to the high-tech internal lining and chemical resistant body but also owing to the self-aspirating attribute of the MACH which significantly reduces any potential for blockage on the gas lines and allows the MACH to operate with low gas supply pressures.







## SECTION 11

### Witwatersrand

---

*Don't just take our word for it...*

**Conduct your MACH test work today and see for yourself!**

The MACH was installed in a boosted leach application on a gold mine in **Witwatersrand, Johannesburg.**

---

The mineralogy is largely silicates with a small quantity of sulphides and non-pregrobbing carbonaceous matter. A marginal but nonetheless profitable recovery enhancement was obtained.

The degree of potential recovery enhancement depends on mineralogy, degree of liberation, and gold occurrence with the highest incremental recovery benefits obtained on sulphidic ores.





## SECTION 11

### Perth, Australia

---

**Get a test rig today!** *These tests are relatively inexpensive and provide a sound scientific spring - board into full scale plant trials.*

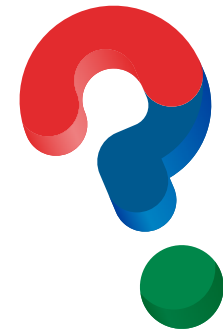
**Gold Ore (Pty) Ltd.** designs and fabricates semi pilot MACH test rigs that are stationed at Mintek and SGS in South Africa and at ALS in Perth.

Several leading mining companies have also decided to purchase their own MACH test rigs for in-house testing on their various Ore types.

---

The rig requires circa 50 litres of pulp per test run which includes a base case test and 2 or 3 MACH tests at different pass rates, for both flotation and leaching applications. MACH preconditioning is executed in the test rig which incorporates a to-scale MACH REACTOR™. Flotation rate tests are then performed separately in a 10 litre benchtop float cell or alternatively, kinetic bottle rolls are performed for leaching applications.





# SECTION 12

## Gold Ore Hypothesis

To explain how we are able to float fine particles with the MACH REACTOR™, Gold Ore (Pty) Ltd. puts forward the following **hypothesis**:

### Step 1: #Dispersion

Gangue is dispersed away from the valuable particle owing to the high degree of mixing in the MACH.

### Step 2: #Nucleation

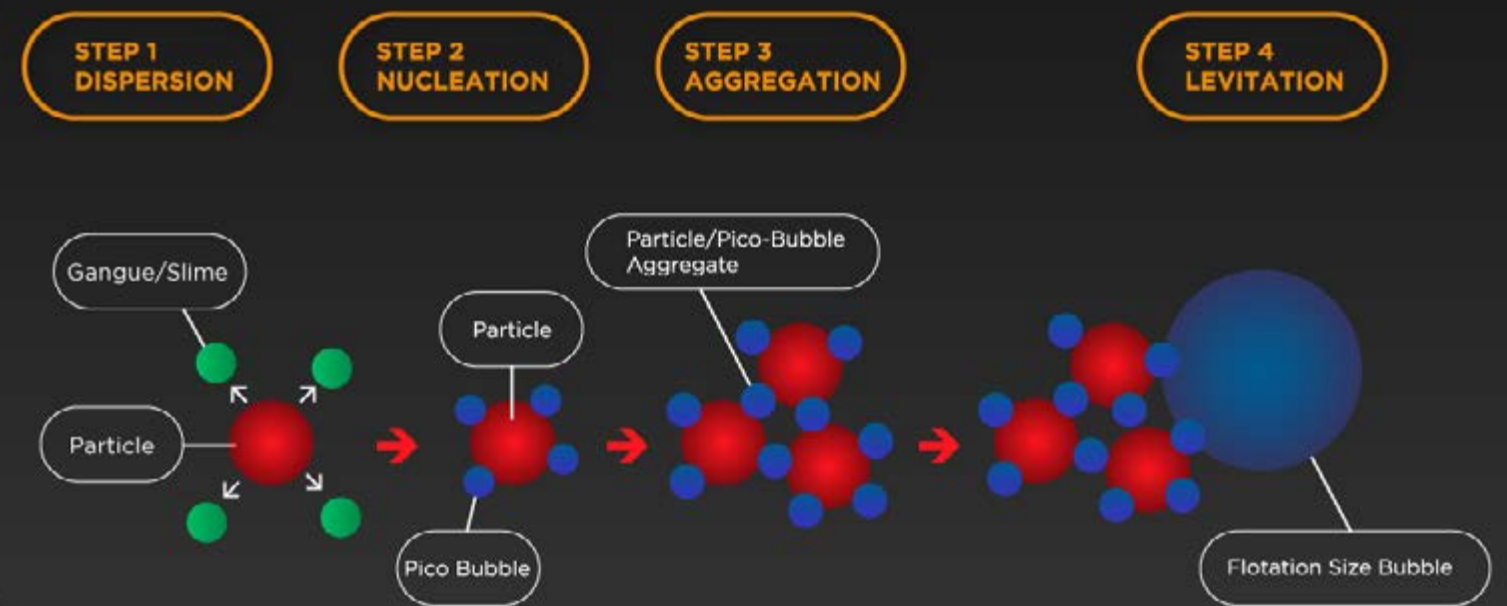
Pico-bubbles nucleate on the particle in the cavitating venturis of the MACH.

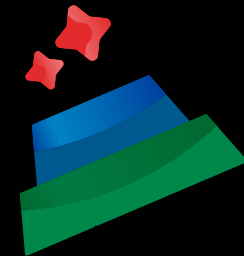
### Step 3: #Aggregation

The particles and pico-bubbles aggregate to move to a lower energy state.

### Step 4: #Levitation

The pico-bubble particle aggregate and then attach to the larger flotation size bubble and are carried to the froth surface, creating **flotation euphoria!**





## SECTION 13

### Refractory Ores

Simply by making an investment today to own or rent your very own MACH REACTOR™, will most certainly result in improving process efficiencies, **leaving less room for error and more room for step change improvements!**

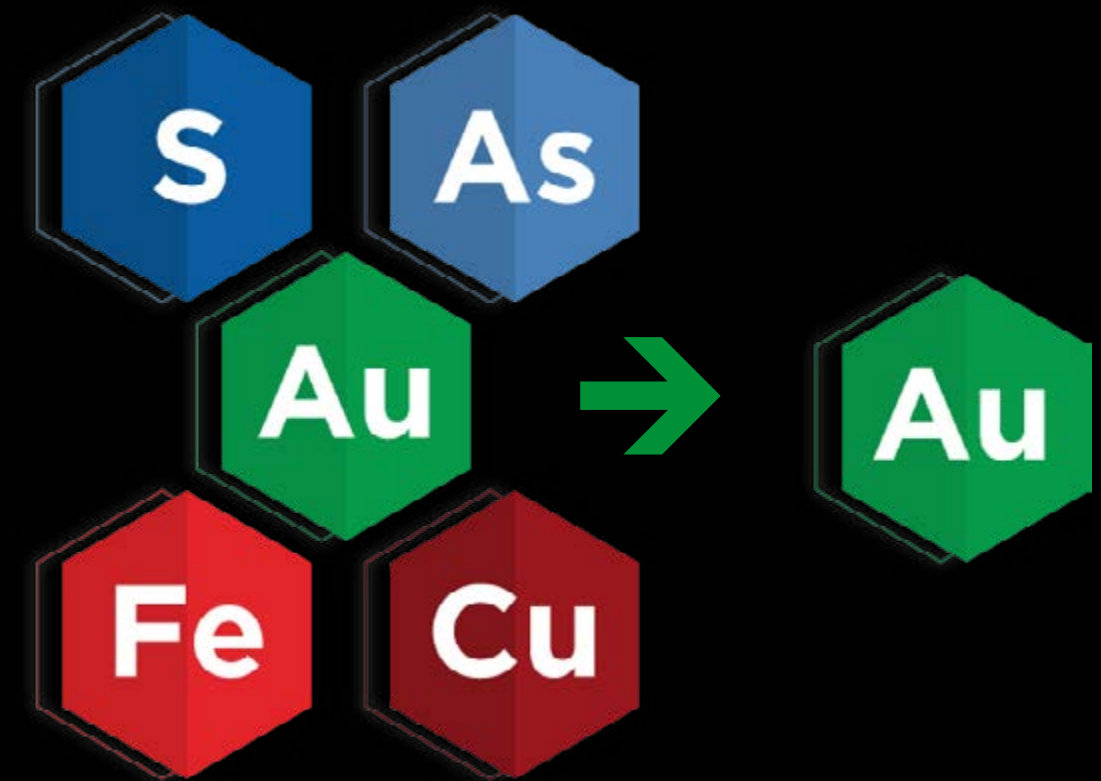
Gold is present in refractory and semi-refractory sulphide gold ores mainly associated with arsenian pyrite and arsenopyrite, where it occurs in both the chemically bonded state and as nano or micron-size grains of metallic gold.

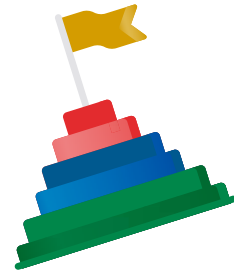
This makes **liberation and extraction difficult** and also potentially expensive when considering other refractory gold technologies.

With aggressive pre-oxidation involving high passes on the MACH, much of the sulphide matrix is destroyed, releasing the bulk of the solid solution or chemically bonded gold.

The chemistry and grind of pre-oxidation may be adjusted to suit the peculiar characteristics of the ore as required in order to optimize recovery.

During this process, much of the environmentally deleterious arsenic is also precipitated as scorodite-like species to provide a both economically feasible and environmentally-friendly process.





# SECTION 14

## Next Steps

So, how can you get your hands on one of these **revolutionary machines?**





# Thank you!

**Connect with Adrian Singh today!**