

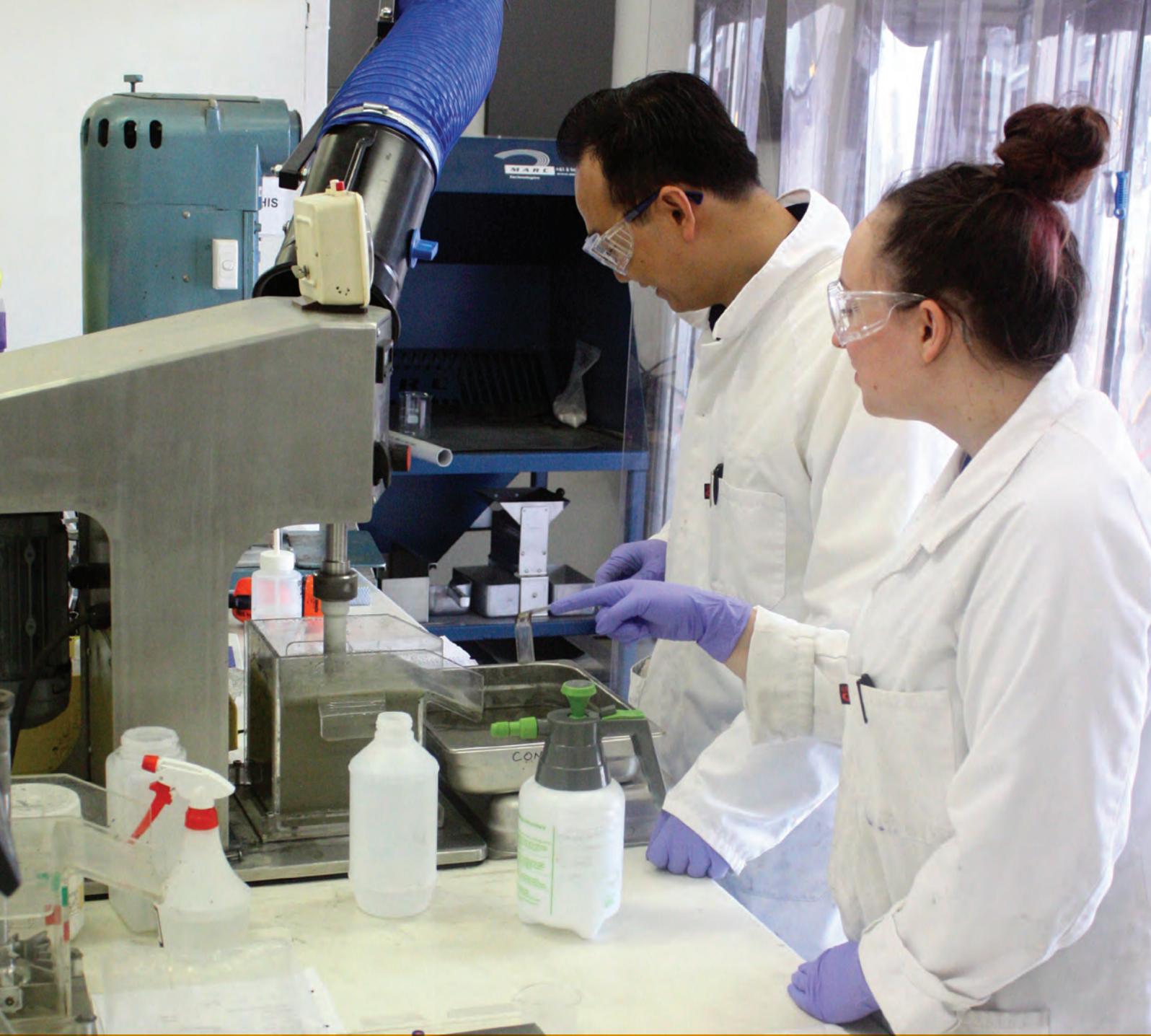


Products for the Mining Industry

Hydrometallurgy and Flotation

INDORAMA
VENTURES
Integrated Oxides & Derivatives

> Empowering potential.



Technology Capabilities

To meet the increasing demands within the mining industry, Indorama has invested in its mining laboratory facilities in Australia, where customer mineral samples can be tested in-house with Indorama's reagents. Our in-house capabilities allow Indorama to quickly and efficiently review our chemistry in combination with a client's existing reagent suite, thus allowing us to optimize the overall chemistry applied and enable a fast turnaround of results and refining of product selection accordingly. These facilities are part of Indorama's commitment and focus to help innovate and develop new chemistries to improve mining efficiencies and meet tomorrow's challenges for the mineral processing industry.



Frother & Frother Analysis

Indorama has the capability to characterize froth properties by utilizing technology like the froth stability column to measure froth formation and decay rates in two and three phase systems. It can be used for frother screening tests on mineral slurries. Indorama also has the capability to measure residual frother concentrations such as glycols/formulated frothers down to the low ppm levels via gas chromatography-mass spectrometry which can help establish baseline levels in process water and frother concentrations at various locations in a circuit.

LOW STRENGTH

■ **POLYFROTH® 10 SERIES FROTHER** are among the weakest of the current POLYFROTH® frother range. They are selective in base and precious metal flotation, producing a mobile, dry froth with low to moderate stability. Performance is comparable to methyl isobutyl carbinol (MIBC) and low molecular weight alcohol-based frothers.

MEDIUM STRENGTH

■ **POLYFROTH® 20 SERIES FROTHER** are highly selective frothers comparable to other low molecular weight alcohol-based frothers. They were specifically designed as high flash point alternatives to MIBC at a significantly lower dose than that of MIBC. This series also offer blended combinations with stronger hydrophobic glycol ether components, boosting the flotation kinetics and giving higher froth concentrate carry-over (mass pull).

INTERMEDIATE STRENGTH

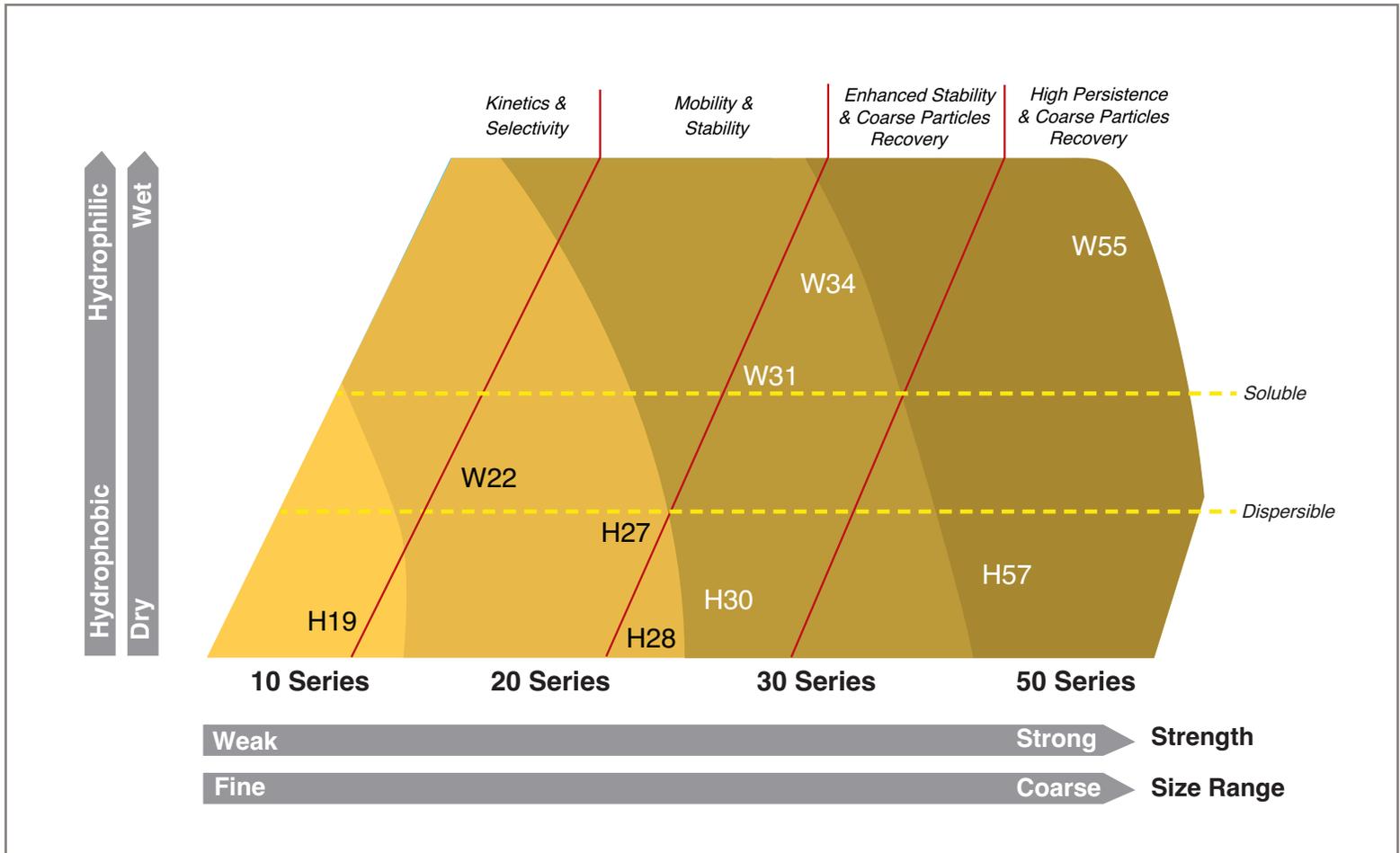
■ **POLYFROTH® 30 SERIES FROTHER** are polyglycol frothers that produce relatively mobile and freely draining froths of intermediate strength. They offer a combination of selectivity, froth stability and moderate kinetics, and therefore can be used in a wide range of flotation applications, where a balance of selectivity and strength is required. They can also be viewed as an alternative frother to other mid-strength, intermediate molecular weight, glycol ether/propylene glycol-based frothers.

HIGH STRENGTH

■ **POLYFROTH® 50 SERIES FROTHER** offer good froth persistence and stability. They are used for operations where strong froths are required to assist bulk flotation of coarse sulfide particles. They offer fast initial kinetics and can be used to help overcome frothing resistance. This typically results in reduced dosage and better froth depth control than other alternative strong alcohol/polyglycol ether blends. They can be combined with other products to augment froth characteristics for desired properties and performance.



POLYFROTH® Frother Series Properties



TYPICAL PROPERTIES					APPLICATION							
	Water Solubility	Specific Gravity (25°C)	Flash Point (°C)	Dynamic Surface Tension (mN/m, 100ppm @ 20°C)	Coal	Copper	Gold-Pyrite	Lead	Molybdenite	Nickel	Potash	Zinc
H19	Sparingly	1.11	>100	69.0	■	■		■	■		■	■
W22	Soluble	0.93	65	67.3	■	■	■	■	■	■	■	■
H27	Sparingly	0.96	70	64.9	■	■	■	■	■	■		■
H28	Sparingly	0.92	65	65.0		■			■	■		■
H30	Sparingly	1.08	108	60.1	■	■	■			■	■	
W31	Soluble	0.98	105	64.4		■	■			■	■	
W34	Soluble	1.02	211	64.6		■				■		
W55	Soluble	1.02	160	63.9			■			■		
H57	Sparingly	0.94	77	59.1	■	■	■			■		

Depressants & Dispersants

Indorama's POLYMAX® and UNIMAX® Depressants are non-ionic, anionic and cationic polymers manufactured for the depression of gangue. These low and intermediate molecular weight polymers are specifically designed to depress iron sulfides, disperse slimes, treat talc bearing ores and disperse clays and silicates.

■ **POLYMAX® G SERIES DEPRESSANTS** are used for carbonaceous or graphitic gangue, typically occurring in sulfide ores. Their fine particle size and porosity provides a high surface area which adsorbs large amounts of reagents. The G series can actively blind and reduce overall high reagent consumption. The G series is also effective as a blinding agent in gold CIP/CIL leach circuits to reduce the gold-cyanide preg-robbing effect of natural carbon.

Typical Applications: Carbonaceous and graphitic ores

■ **POLYMAX® K SERIES DEPRESSANTS** are versatile dispersants used to facilitate the rejection of clays, fibrous minerals and hydrophobic gangue typically found in sulfide ores. Again, these are useful in improving concentrate grades.

Typical Applications: Clays, silicates, carbonates and asbestos

■ **POLYMAX® T SERIES DEPRESSANTS** are aqueous solutions of a high molecular weight poly (oxyalkylene) glycol. They are low foam dispersants, effective for fine gangue particles (dolomites, etc.) and clays. They can also modify froths to reduce entrainment. They are useful for MgO rejection and therefore improving metal recovery in sulfide flotation.

Typical Applications: Clays, MgO, dolomites, silicates and talcs

■ **UNIMAX® SERIES DEPRESSANTS** are iron sulfide (pyrite, pyrrhotite, marcasite) depressants used in recovery of base metal sulfides. They were also designed as an alternative partial cyanide replacement to depress iron and zinc sulfides in lead-zinc flotation.

Typical Applications: Iron sulfides and metal sulfides



Coagulants

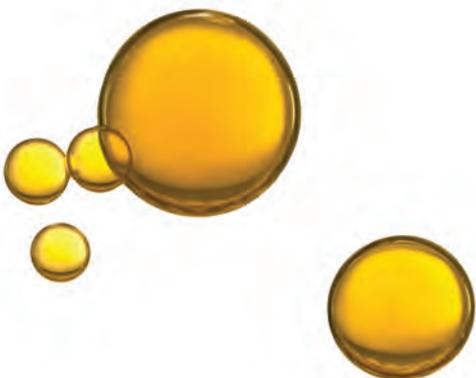
Indorama's POLYSIL® coagulants are designed for use in the mining industry for the treatment of fine particles in aqueous suspension across a broad pH range. POLYSIL® coagulants are one of the few reagents that are effective against the colloidal silica formed during the leaching of ores or slags containing silicates. Colloidal silica, building up in process liquors can cause a number of problems including interfering with flocculation, initiating crud formation in solvent extraction (SX), decreasing SX extraction kinetics and increasing SX phase disengagement times.

POLYSIL® coagulants work by assisting the removal of this colloidal silica by promoting the agglomeration of the particles. The coagulants have a "lock and key" relationship with the surface of colloidal silica as the coagulants have a similar hydrogen bonding spacing to colloidal silica. This allows them to bind to the surface, displacing the water, and destabilizing the colloid. The increase in size of the coagulated silica particles allow it to be more readily settled or flocculated in the clarifier or filter used on the leachate prior to sending it to SX.

Indorama's POLYSIL® coagulants offer an economic treatment of colloidal silica to help lower the concentration of these particles in solution, improve process efficiency and reduce organic reagent losses by minimizing crud formation.

■ **POLYSIL® RM SERIES COAGULANTS** are liquid polymeric coagulants for the treatment of fine particles in aqueous suspension. The POLYSIL® coagulants range is designed to be effective against colloidal silica across a broad pH range.

Typical Applications: Colloidal silica, crud and fine particles



About Indorama

Indorama Ventures is a world-class chemicals company and a global integrated leader in PET and fibers serving major customers in diversified end-use markets. Following our core strategies, we develop innovative products for customer needs and make great products for society. Headquartered in Bangkok, Thailand, Indorama Ventures has operating sites in 31 countries on five continents – in Africa, Americas, Asia, Europe & Eurasia.

Integrated Oxides & Derivatives

Indorama Ventures Oxides & Derivatives is a leading chemical intermediates and surfactants producer with a diverse range of products in growth markets such as home & personal care, agrochemicals, oilfield technologies, fuel & lube additives and more.

In January 2020, Indorama Ventures Public Company Limited completed its acquisition of Huntsman's world-class integrated oxides and derivative business, including:

- **Surfactants:** Integrated producer of a wide range of products for home and personal care, oilfield technologies, agriculture and process industries.
- **Ethylene and Derivatives:** Highly integrated manufacturer of ethylene, ethylene oxide, ethylene glycol and other derivatives.

Our operations include a large flagship site on the US Gulf Coast (USGC) at Port Neches, as well as Chocolate Bayou and Dayton in Texas, Ankleshwar, India and Botany, Australia.

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