Mineral Technologies
A Downer Company

CELEBRATING 80 YEARS

Mineral sands processing

Downer
Relationships creating success

The world's leading producers rely on us to deliver processing solutions for mineral sands

With over 80 years' proven experience, we bring unrivalled expertise and the latest technologies to help our customers process their mineral sands into saleable products.

Our first step is understanding your project vision

Success is achieved through skilled, passionate people working together in pursuit of a shared vision and goals.

The very first step we take in working with our customers is to **listen and understand what success for the project looks like.**

We then go out of our way to work collaboratively with our customer teams, based on our shared understanding of the project goals and timeframes.

Working from this understanding we deliver a comprehensive range of testing, plant design, equipment and services to achieve our customers' vision across all stages of the project lifecycle.

Experience delivers results

From our beginnings in the 1940s separating fine minerals along Australia's east coast, we have expanded to become the global leader in mineral sands processing. Today, we are recognised by customers worldwide as the **'go to' partner for fine mineral sands processing solutions across the project lifecycle**.

Customers call us when they need fast, cost effective processing solutions to **lower costs, convert tailings into revenue or design mineral sands plants.**

Importantly, we also support NI 43-101 requirements as qualified experts for the processing section of technical reports.

Worldwide, our involvement and participation in projects provides customers with confidence in a successful outcome.

Zero Harm is embedded in our culture and is fundamental to our future success. We are committed to achieving our goal of Zero Harm across all regions in which we operate.

ZERO HARM

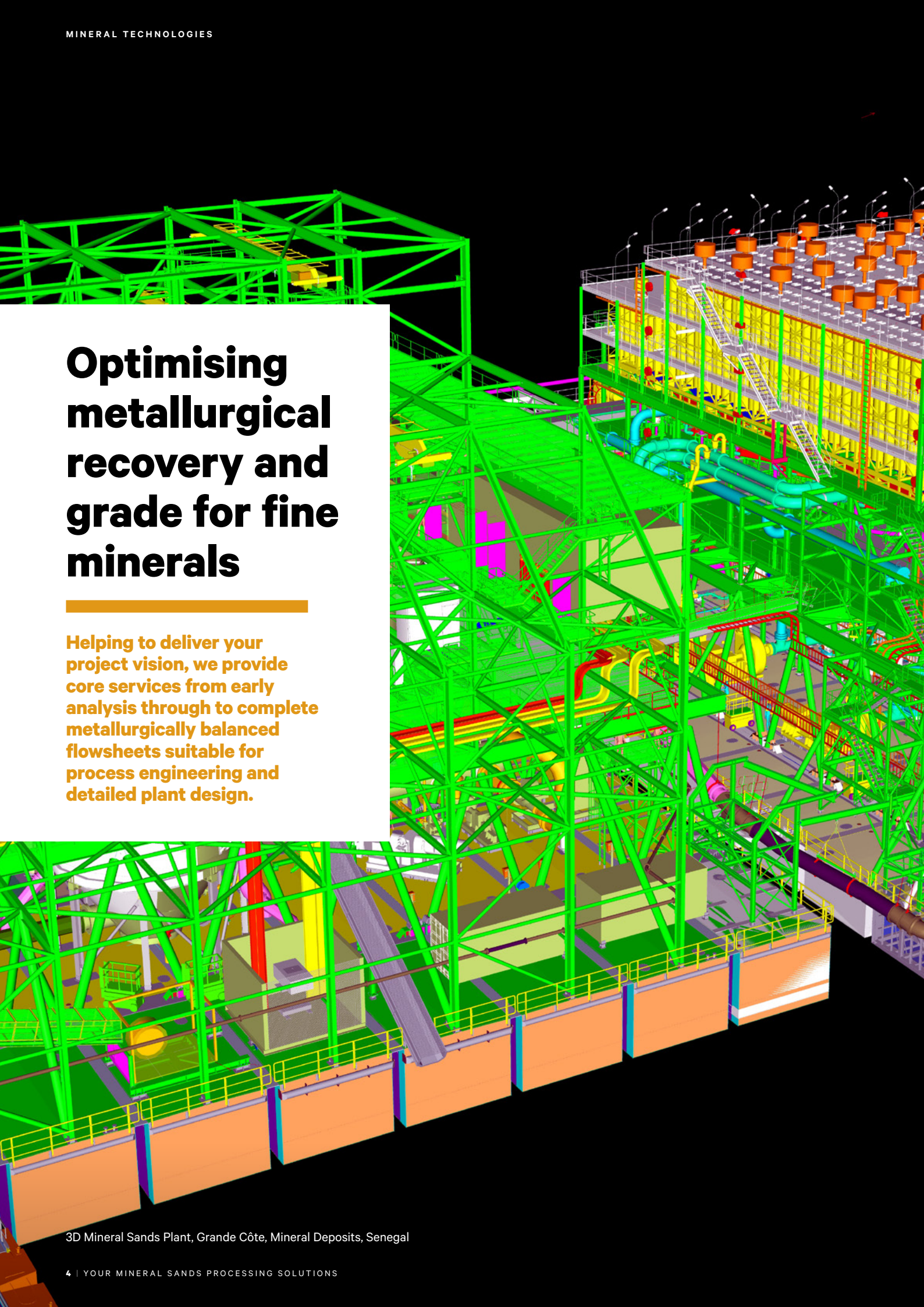
Cover: Mineral Sands WCP, Ginkgo, Tronox Mining, Australia

No one knows mineral sands processing like we do. From the largest mineral sands plant Grande Côte in Senegal to process solutions for Chemours on North America's east coast and a large number of projects across Africa, India, Europe and Australasia, our teams deliver unrivaled expertise in mineral sands processing across the project lifecycle.

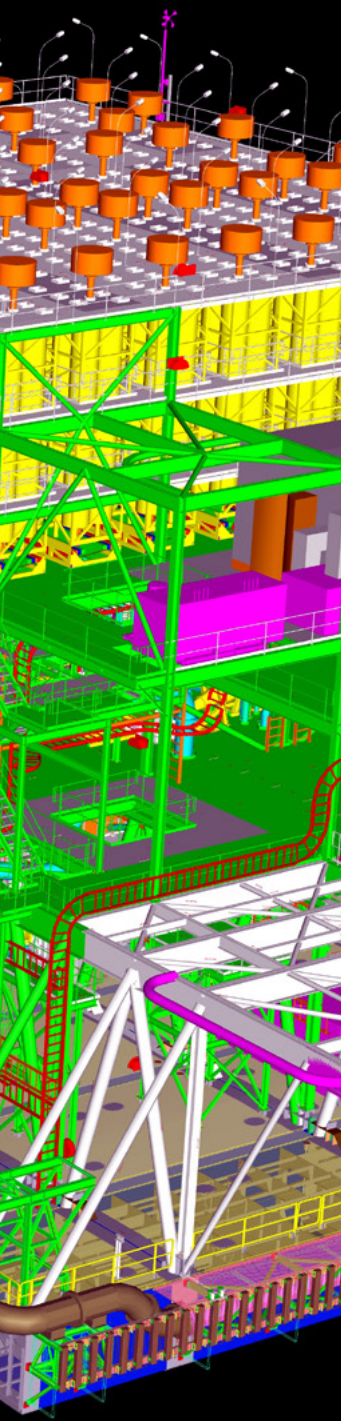
World's largest mineral sands plant, Grande Côte, Mineral Deposits, Senegal

Optimising metallurgical recovery and grade for fine minerals

Helping to deliver your project vision, we provide core services from early analysis through to complete metallurgically balanced flowsheets suitable for process engineering and detailed plant design.



3D Mineral Sands Plant, Grande Côte, Mineral Deposits, Senegal



No two ore bodies are the same

Our multi-disciplined engineering teams draw from proven global experience in mineral sands processing to deliver prefeasibility and feasibility studies that inform detailed design for new plants and upgrades to existing plants for mineral sands processing worldwide.

More than just a laboratory

Our process engineers begin with exploring and interrogating mineral sands processing solutions utilising testwork programs specifically designed to maximise the extraction of ilmenite, rutile, zircon and other fine minerals.

Drawing on 80 years' experience our process engineers develop flowsheets that extract ore of varying grades into saleable products.

We test samples as small as 100 grams for characterisation through to larger samples up to 2,000 kilograms. Our testing uses state-of-the-art processing equipment for crushing, grinding, classification, and gravity separation as well as high and low intensity magnetic separation for wet and dry applications for fine minerals.

Our laboratory has the capability to create multi-stage pilot scale circuits to treat bulk samples (80-100 tonnes) for process testing and circuit optimisation.

We deliver metallurgical testwork for mineral sands samples from major mining regions including Australasia, the Americas, Europe, Africa and India.

Concept and feasibility

From our testwork we deliver concept, prefeasibility and feasibility studies as well as cost effective flowsheets to safely and efficiently extract the fine minerals.

Where the ore is different and challenging, we bring innovative capabilities to design new and unique solutions that augment and lift the potential of conventional flowsheets to extract the fine minerals.

By way of example, we delivered extensive testwork and feasibility studies for the world's largest mineral sands plant, Grande Côte in Senegal.

Mining began at the Grande Côte project in 2014. This marked the 13th year of Mineral Technologies' long association with the project.

Starting in 2001, Mineral Technologies conducted the first metallurgical testing of 100 tonne bulk samples. Over the years this expanded into further testing resulting in the development of process flowsheets to deliver optimum separation of zircon and ilmenite.

Given our proven expertise in fine mineral separation and considered metallurgical knowledge of the ore body, Mineral Technologies was engaged to design the wet concentrator plant which would become the world's largest mineral sands spiral plant. In addition, we were engaged to design specific process equipment including a 7,000 tonnes per hour surge bin and densification modules.

Innovative plant design

Extending beyond traditional spiral plants, our designs for mineral sands processing incorporate gravity, electrostatic and magnetic processing equipment with capacities ranging from 5 to 7,000 tonnes per hour.

Our new *FLEX*SERIES of modular, relocatable plants are a game changer for mineral sands operators. Cleverly conceived as an 'off-the-shelf', affordable solution, the *FLEX*SERIES does not compromise on metallurgical performance. The *FLEX*SERIES also offers a range of plant options which are fully customisable to suit any fine mineral resource, no matter how complex.

Project execution and equipment selection

Our teams work onsite with customers throughout the installation and commissioning stages to ensure benefication targets are met.

We then continue to work with customers through project lifecycles to deliver ongoing support and processing expertise to ensure project goals are achieved.

Industry leading technology

Customers value our ongoing commitment to researching and developing new, innovative equipment designs that extract maximum value from mineral sands.

Equipment development and selection

When purchasing new equipment, we understand that our customers need to ensure the equipment fits within tight capital expenditure budgets and maximises grades and recovery while delivering low operational costs.

Mineral Technologies' equipment is designed and manufactured using the latest technologies and is fully tested in processing operations to ensure optimal performance. When we release new process equipment you can be assured that it will be fit-for-purpose and cost effective.

Over recent years our MG12 spirals have become the spiral of choice for wet concentration plants. Customers have successfully utilised these spirals to reduce the number of spiral stages whilst providing superior efficiency compared to the MG6.3 circuits of previous decades.

Our work with Chemours in the USA is a good example of the deployment of MG12 spirals to achieve high recoveries.

More recently we have developed the Compact Turbo (CT1) spiral which has proven its capability to operate at high densities and maintain or exceed MG12 recoveries on various mineral sands feed types.

We also develop bespoke solutions to solve specific separation challenges. A good example being spiral modifications for Richards Bay Minerals in South Africa to meet our customer's specific process needs.

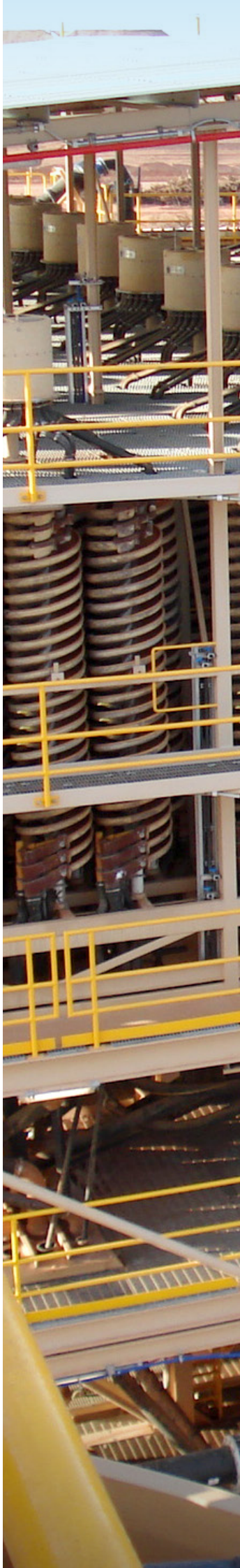
The latest range of equipment for mineral sands processing includes:

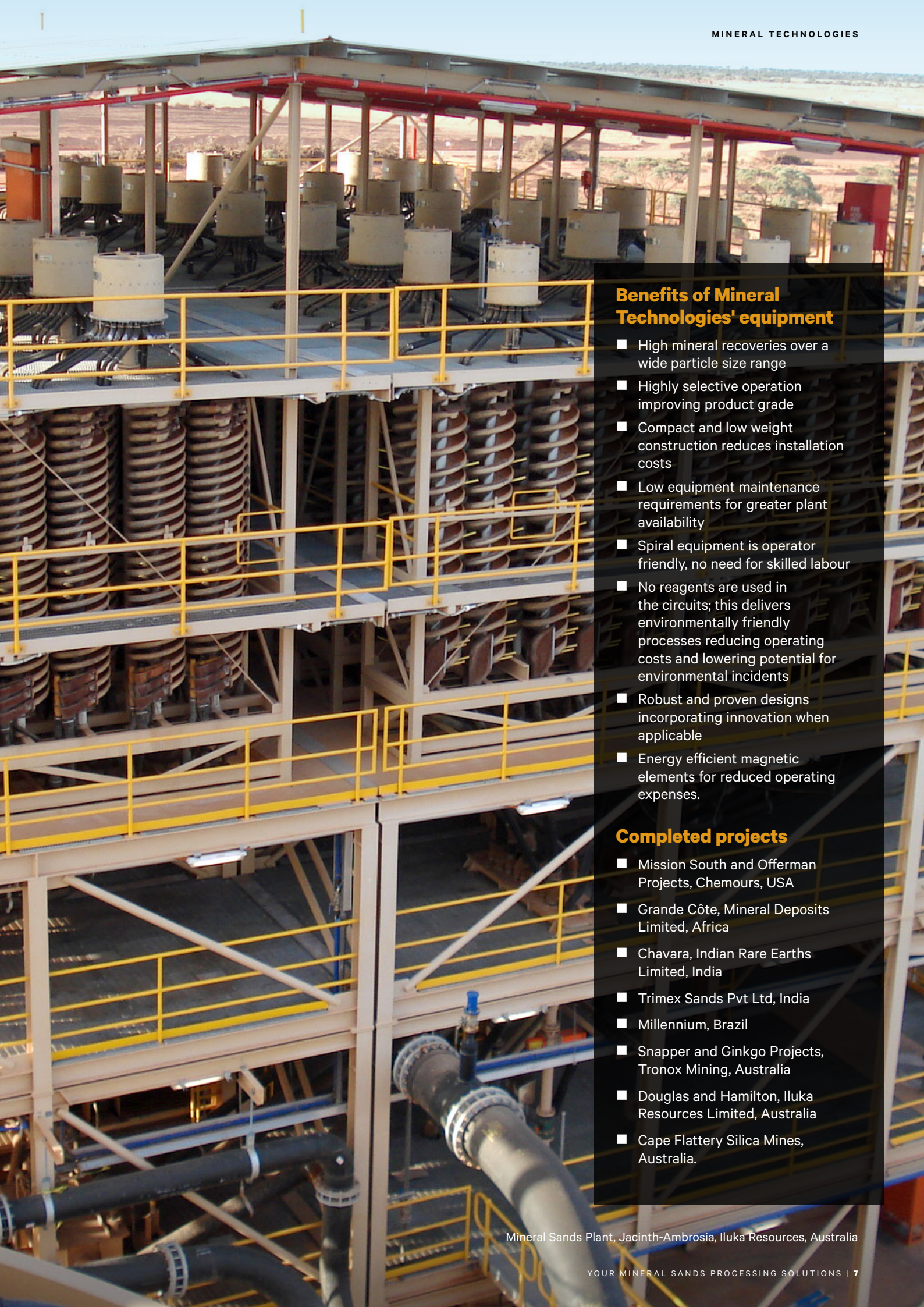
- MG6.3 and MG12 Spiral Separators for low to medium grade feed
- HG10i and VHGS Spiral Separators for high to very high feed grades
- Compact Turbo (CT1) Spiral Separators for high density processing
- FM1 Spiral Separators for particles below 150 micron
- Reading Wet High Intensity Magnetic Separators (WHIMS), Low to Medium Intensity Magnetic Separators (LIMS & MIMS) and Rare Earth Magnetic Separators (REMS)
- Carrara High Tension Roll (HTR) Separator
- Innovative surge bin technology Lyons Feed Control Unit (LFCU).

Customers using our WHIMS equipment value the reliability and separation efficiency. For electrostatic separation, the recently released HTR400 incorporates robust composite electrodes, and delivers high throughput with low operating costs.

Our innovative surge bin technology, Lyons Feed Control Unit (LFCU), has been deployed into fine minerals for many years.

LFCU's are installed at Chemours in the USA for mineral sands processing and we are currently installing the largest LFCU's ever constructed at 24 meters in diameter for fine iron ore beneficiation in Australia.





Benefits of Mineral Technologies' equipment

- High mineral recoveries over a wide particle size range
- Highly selective operation improving product grade
- Compact and low weight construction reduces installation costs
- Low equipment maintenance requirements for greater plant availability
- Spiral equipment is operator friendly, no need for skilled labour
- No reagents are used in the circuits; this delivers environmentally friendly processes reducing operating costs and lowering potential for environmental incidents
- Robust and proven designs incorporating innovation when applicable
- Energy efficient magnetic elements for reduced operating expenses.

Completed projects

- Mission South and Offerman Projects, Chemours, USA
- Grande Côte, Mineral Deposits Limited, Africa
- Chavara, Indian Rare Earths Limited, India
- Trimex Sands Pvt Ltd, India
- Millennium, Brazil
- Snapper and Ginkgo Projects, Tronox Mining, Australia
- Douglas and Hamilton, Iluka Resources Limited, Australia
- Cape Flattery Silica Mines, Australia.

Mineral Sands Plant, Jacinth-Ambrosia, Iluka Resources, Australia

Relationships creating success

Our experience in delivering fine mineral processing solutions ensures that we understand what's important for our customers' project success.

Mineral Sands WCP, Mission South, Chemours, USA

We work hard to create and sustain valued relationships that enable our teams to fully understand, predict and deliver solutions that turn possibilities into reality for our customers.

Chemours, USA

In 2014, the Mission South Wet Concentration Plant (WCP) began operation right on schedule. Mineral Technologies' involvement spanned over two years starting with early confirmatory metallurgical testing to develop process flowsheets and preparation of early prefeasibility studies.

In 2012 Mineral Technologies was appointed to design the WCP. A dedicated design team of engineers and drafters from Mineral Technologies' Australian and USA operations was assembled to prepare basic and detailed design for the WCP as well as critical separation equipment including an 8 metre diameter surge bin based on the innovative Lyons Feed Control Unit (LFCU) design.

During the construction phase, Mineral Technologies provided onsite process engineering support to assist with assembly and installation of equipment as well as site support during start-up of key process equipment.

The WCP incorporates state-of-the-art spiral technology specifically designed for fine mineral separation. The MG12 spirals deliver high recoveries even with finer valuable heavy mineral sizes. The WCP also includes a fit for purpose, custom built Lyons Feed Control Unit to meet Chemours, specific process needs.

Today Mission South is a leading example of excellence in Mineral Sand separation, and through smart design and innovative technology is expected to provide many years of high value service.

Tronox Mining, Australia

Located 220 kilometres from Broken Hill, the Ginkgo Mine was the first commercial mining operation in the Murray Basin. It contains 5.8 million tonnes of heavy mineral, with an excellent suite of products including zircon.

Mineral Technologies delivered a fully integrated solution starting with initial testing of the deposit to determine optimum processing methods and flowsheet design through to design of the wet processing plant, plant construction, supply of processing equipment, commissioning and operator training of the site team.

A key feature of the project was the conversion of an 850 tonnes per hour floating concentrator into a 1,750 tonnes per hour plant.

This was facilitated by innovative re-design and utilisation of MD high capacity spirals and Reading magnetic separators. This technology was selected based on extensive metallurgical testing and resulted in a reduction of plant capital expenditure by 25%, significantly improving the project's viability.

Design of the plant was fully modelled to allow online adjustment of operation for varying feed conditions.

Trimex Sands, India

Mineral Technologies delivered a fully integrated solution to Trimex Sands Pvt Ltd.

One of the largest mineral separation plants for heavy minerals from beach sands on the Indian subcontinent.

Testwork began in 2004 and progressed to flowsheet and basic plant design in 2006.

Plant design incorporated wet and dry processing stages. Mineral Technologies supplied state-of-the-art spiral, magnetic and electrostatic technology from our proprietary range of process equipment; as well as engineered equipment including a large grizzly screen hopper and trommel, and a Lyons Feed Control Unit (LFCU) to manage the storage and discharge of wet solids to meet specific process needs.

Plant construction was undertaken by a locally based company.

Mineral Technologies provided members of our process engineering team to commission the plants and fine-tune the process for optimum grade and recovery.

Fine minerals processing

We are the go-to partner for mineral sands processing solutions across the project lifecycle. Our expert teams are based in major mining regions worldwide. Talk to us today about how we can bring our proven mineral sands processing solutions to help your projects succeed.

START

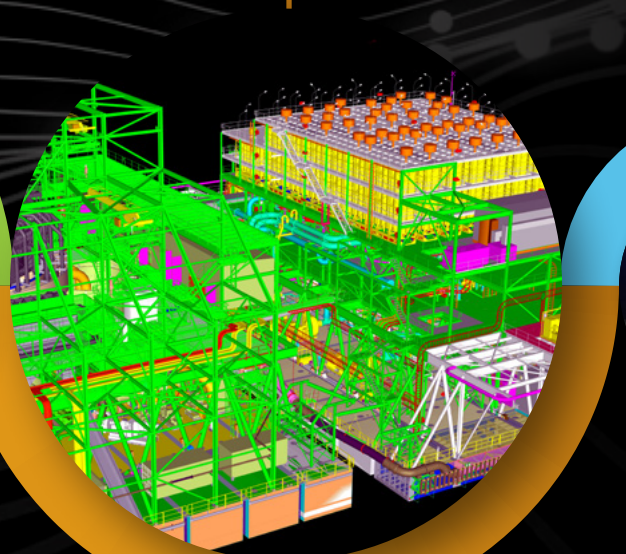
Metallurgical testing and process design

More than just a laboratory, our process engineers explore and interrogate mineral processing solutions utilising latest testwork programs specifically designed to extract ilmenite, rutile, zircon and other fine minerals. Drawing on 80 years' experience our process engineers develop flowsheets that extract minerals of varying grades into saleable product.

01

Engineering design and studies

We know that no two ore bodies are the same so a 'one size fits all' solution never works. Our multi-disciplined engineering team draws from proven global experience in mineral sands processing to deliver prefeasibility and feasibility studies that inform detailed design for new plants and upgrades to existing plants.



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Project exe equipmen

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t selection**

Our engineering team of over 150 people across multiple offices develops plant designs incorporating the latest technologies for mineral sands processing and work onsite with customers throughout the installation and commissioning stages.

With over 80 years' experience we confidently deliver our process solutions and plant designs to customers worldwide. We carefully guide customers through each stage of the process - from delivery to initial set-up and commissioning.

Ongoing support is a key part of our commitment to ensuring project success. This includes site visits and monitoring tools to maximise process performance.

Ongoing plant optimisation to meet project objectives

03

SHIP

Shippable mineral sands product

Our end-to-end mineral sands processing solutions help customers achieve project goals efficiently and profitably. Talk to us today about how we can bring our proven mineral sands processing solutions to help your projects succeed.

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