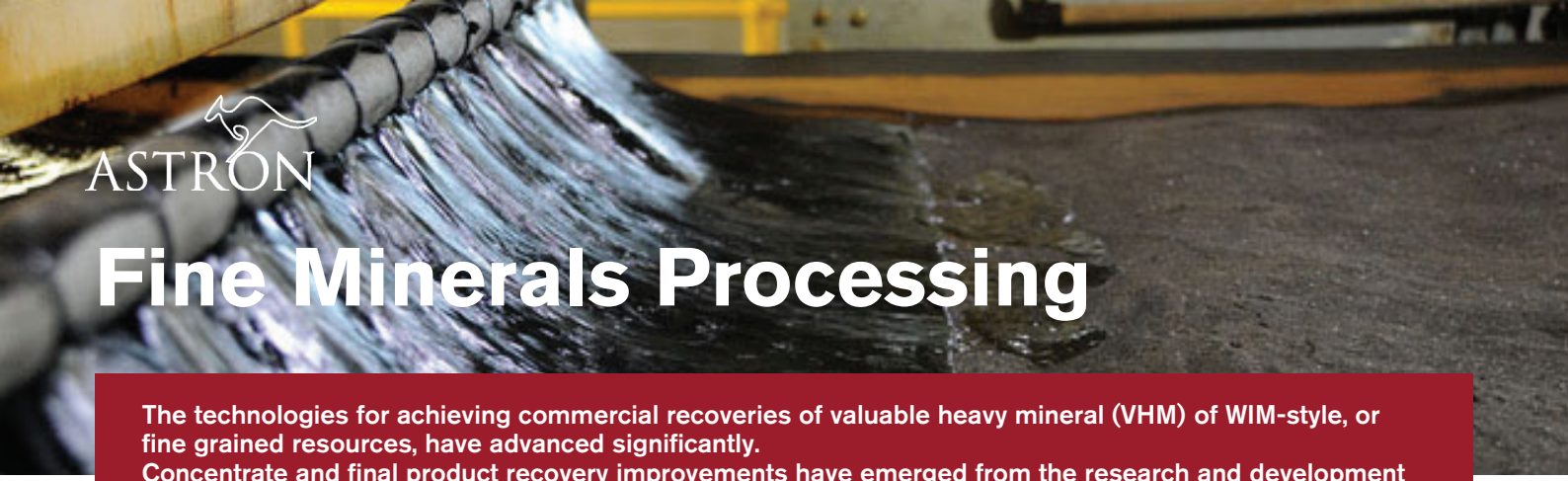


Fine Minerals Processing

The technologies for achieving commercial recoveries of valuable heavy mineral (VHM) of WIM-style, or fine grained resources, have advanced significantly.
Concentrate and final product recovery improvements have emerged from the research and development stages of WIM-style projects, associated with a long term commitment from industry participants, such as Astron, as well as specialist industry technical consultants and metallurgical equipment manufacturers.

Advancements in spiral, floatation and classifier technologies have been trialled across several projects globally. Equipment selection for fine-grained deposits now represents a standard processing set, capable of achieving efficient and reliable outcomes.

Spiral design and testing work has enabled the fine minerals, representative of the Donald deposit, to be recovered through gravity separation methods.

In 2015 the first successful processing of Donald ore was undertaken in a pilot plant, using ore removed from the test pit in the same year. The pilot plant consisted of a trommel/vibrating screen to remove oversize material, de-sliming cyclones to remove slimes and two stages of fine material spiral separators to produce a HMC containing 19.9% HM, with an overall HM recovery of 84.8% and a zircon recovery of 91.2%. This material was further processed in a concentrate upgrade circuit, consisting of two stages of wet high intensity magnetic separators to produce magnetic and non-magnetic concentrates and a five-stage spiral separator/wet shaking table circuit to upgrade the non-magnetic concentrate to a HMC containing >90% HM.

Overall mineral recoveries were calculated at 94.9% for zircon, 87% for rutile, 73% for leucoxene and 98% for ilmenite (recovery to magnetic and non-magnetic fraction). Rare earth element (REE) recovery was achieved at 96% overall, with 64% Cerium.

Material from the concentrate upgrade process was further processed in a mineral separation circuit consisting of a primary electrostatic circuit, wet zircon circuit, dry zircon circuit and HiTi circuit.

In 2020, a test pit enabled further ore to be recovered. Astron retained Mineral Technologies to undertake wet concentrator piloting work, utilising a purpose built 1:121 scale plant constructed in accordance with the designs of the wet concentration plant (WCP) compiled during earlier feasibility studies for the Donald project. Recovery of VHM was achieved at both 85% and 95% HMC grade respectively. Running concurrently with the bulk sample pilot program, Astron conducted metallurgical test work which confirmed mineral separation concept flow sheet priorities and demonstrated improved zircon and titanium recoveries from varying equipment selection utilising conventional approaches. Further opportunities were identified to explore conventional or hybrid mineral separation configurations to reduce recirculating loads, facilitating one-pass separation outcomes, as well as associated circuit simplification.

The results confirmed no negative impacts in VHM recovery and demonstrated the selective rejection of low value minerals, which in turn has the potential to improve operating and materials handling efficiencies.

As disclosed in February 2021, mineral separation test work undertaken by Astron in conjunction with technical consultants achieved the following main results:

Rare Earth Recoveries

- Floatation testing using a conventional re-agent produced a mixed rare earth concentrate stream containing 51.2% total REE with low impurities;
- using CeO_2 as a tracer, rare earth mineral recovery to final rare earth mineral concentrate was calculated to be up to 94.6% relative to HMC, using a wet process only;
- further separation to a light rare earth concentrate with mineral assemblage of 51.3% of light rare earth elements (La, Ce, Pr, Nd, Sm, Eu, Gd) and a heavy rare earth concentrate containing 26.1% heavy rare earth elements (Tb, Dy, Ho, Er, Tm, Yb, Lu, Y) was achieved.

Zircon Recoveries

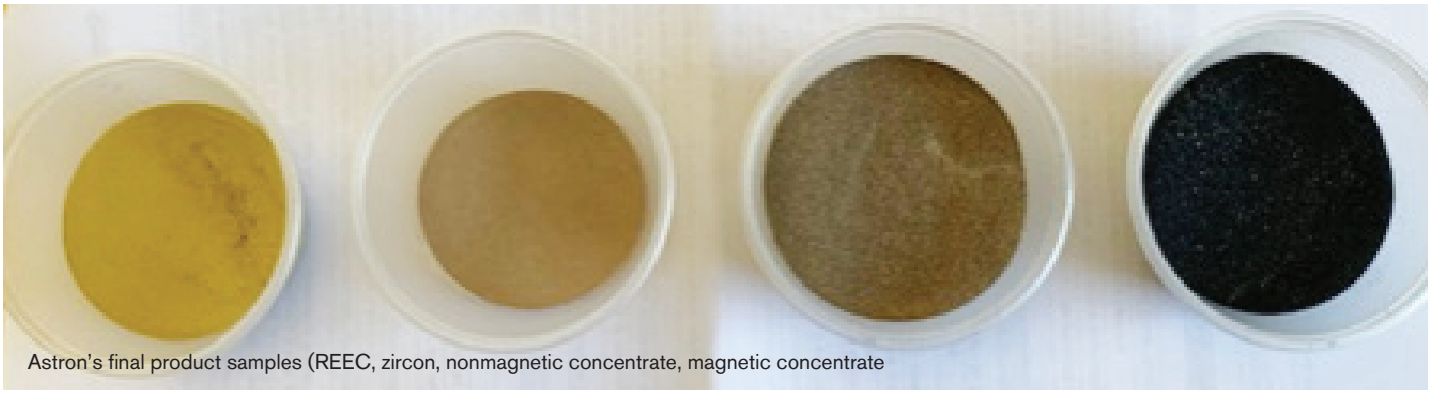
- High quality zircon specifications with assemblage characteristics of ZrO_2 > 66.0%, TiO_2 < 0.15%, Fe_2O_3 < 0.1%, Al_2O_3 < 0.1%, were achieved;
- optimisations of the downstream circuits has the potential to significantly improve ZrO_2 recovery to 90.6% relative to HMC;
- recovery to high quality zircon was calculated to be 72.6% relative to HMC;
- an additional 18% of zircon is expected to report as a zircon product with >60% ZrO_2.

Titania Product Recoveries

- The metallurgical test work produced a combined titania concentrate with 64.9% titanium dioxide content (TiO_2);
- opportunities were identified to lower the silica content within titania concentrate to enable direct processing in a chlorinator slag plant.

ASTRON

Fine Mineral Processing



Astron's final product samples (REEC, zircon, nonmagnetic concentrate, magnetic concentrate

Overall Findings

- The test work has enabled Astron's mineral separation process to be significantly simplified from previous versions;
- the hybrid process adopted is well-understood and presents relatively little technical risk;
- given there will only be one stage of drying for the materials, this is expected to contribute to lower operating costs in the separation process than originally envisaged;
- associated with the removal of the rare earth elements prior to separation of the mineral sands constituents of the HMC, the subsequent concentrate had a natural radioactivity of under 9 becquerel/gram (Bq/g), and will be able to be transported under Victorian regulatory arrangements;
- the scope of works confirms the practicality of conducting downstream mineral separation in Australia, and Astron intends to investigate opportunities for an integrated mining, concentrating and final product separation concept for the Donald project; and
- given test results were achieved via a pass through batch process, it can be anticipated that on a continuing operating basis, further improvements in recoveries may be expected.

Stage two piloting with Mineral Technologies will produce final product sample kits for product market introductions to customers for the purpose of finalising offtake arrangements.

Mineral separation – finished products

Final project scoping is determining the relative benefits of two alternative options for HMC processing: offshore processing of HMC or on-shore, Australian HMC processing, enabling an integrated operation from resource to final products.

- Zircon sand – it is expected that ~80% of the zircon production stream will be premium grade zircon, not requiring further treatment (such as hot acid leaching) to meet customer specifications.
- Titanium dioxide (or titania) products – ilmenite, rutile and leucoxene. Initially, it is planned to produce a combined titania of 61% TiO2 content.
- Rare earth concentrates, recovered from flotation processes at the wet concentration stage.