ProMine

Factsheet presenting new nano-particle products made out of mining waste streams

Nano-particle products

January 2013

Products made out of mining waste streams reduce the environmental footprint of mining

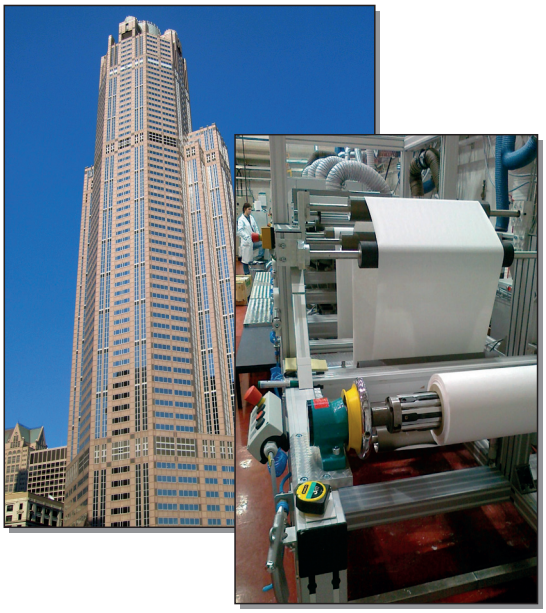
Research into new applications for nano scale raw materials in ProMine has led to the development of several innovative high value nano-particle products. A Life Cycle Assessment (LCA) was performed to assess the environmental impact of the new products and their production processes.

Nano-silica

Nano-silica is produced from the utilisation of two mining waste streams: concentrated acid from the processing of copper-gold concentrates and olivine waste rock.

Nano-silica for special concrete enhances the mechanical strength of concrete by decreasing the porosity and increasing the material's bulk density.

Nano-silica for paper coating can be used for high quality paper for inkjet applications, characterized by increased print density and ink absorption. Furthermore, nano-silica can be used as a functional filler to prepare paper for production of coated abrasives, providing good rheology and dispersability and good mechanical properties.



Schwertmannite

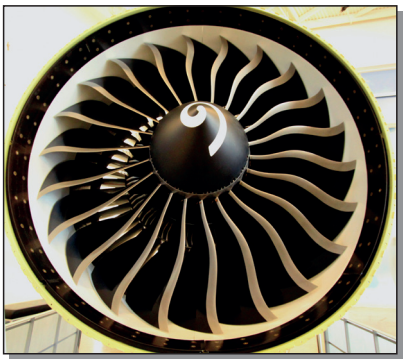
Schwertmannite is produced from acid mine water, by an energy efficient and natural microbial process.

Iron rich and high purity **schwertmannite for colour pigments** can be used in anticorrosive coatings, paints, ceramics and bricks. It results in products that are resistant to the most aggressive weather conditions, including salt spray.

Schwertmannite for water treatment is used to adsorb arsenic and metal anions from mining water and industrial effluents. It has very high sorption capacity for arsenic and good sorption kinetics. Using schwertmannite results in very low leakage of arsenic from the loaded material, which is a requirement for landfilling. It is cheaper to produce than other adsorbents used for water treatment.

Rhenium

Rhenium is produced from copper smelter waste. **Spherical rhenium powder** is a new product on the market and can be used in coatings in gas turbines. Rhenium powders – **Re-Ni and Re-Co powder** – are used in superalloys in engines in aircrafts and aerospace technology. Using rhenium contributes to higher purity and homogeneity, and provides high durability and heat resistance in turbine blades and engines. Rhenium exhibits some exceptional features: it has lower porosity, higher density, better liquidity, and greater durability than most other elements. It is considered a strategic metal because of these special characteristics and its industrial importance.



Environmental assessment

A Life Cycle Assessment was conducted to assess the environmental impacts of the products and production processes

	Before	After	Environmental benefits
Nano-silica	• Waste rock accumulated • High-temperature process • Large demand for raw materials for cement	• Waste streams used as raw material • Low-temperature process: energy efficient • Less use of cement, but stronger concrete • Adaptable product • Possible wider application	• Nano-silica production process utilises dunite waste rock and by-product acid from tailings • Production of nano-silica is an exothermal process; it uses less energy than similar products on the market • Nano-silica for special *concrete* reduces the need for cement, which accounts for 5-10% of global CO_2 emissions • Using nano-silica instead of latex in *paper coating* in abrasive paper production results in a lower environmental burden
Schwertmannite	• Mine water treatment by oxygenation and liming • Iron hydroxide sludge is disposed of as waste	• New, valuable products (pigments & adsorbents) • Less waste • Possible wider application, e.g. in water purification	• Schwertmannite is produced from mine water in a microbial process • Reduction of calcium oxide consumption • Reduced amount of solid wastes and sulphate emissions • Schwertmannite for *water treatment* effectively removes toxic waste products from mining and industrial effluents • Schwertmannite has the potential to recover phosphate from waste water
Rhenium	• Production from waste streams	• More refined product(s) • Adaptation to customer needs • Increased sales value	• Rhenium is produced from smelter waste streams: from flue gas cleaning liquid in copper production • Rhenium products utilise green chemistry, reducing the use of hazardous substances in the manufacturing process

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