The ERMS SR Process:

Advantages and Opportunities

John Winter

General Manager - Technology Development

AUSTPAC RESOURCES N.L.

Key Mineral Processing Technologies:

Developed by Austpac to treat mineral sands

- **ERMS SR** — Roasts and leaches ilmenite to produce high grade synthetic rutile ("SR")
- **EARS** — Converts iron chlorides in spent leach liquors into hydrochloric acid and iron pellets

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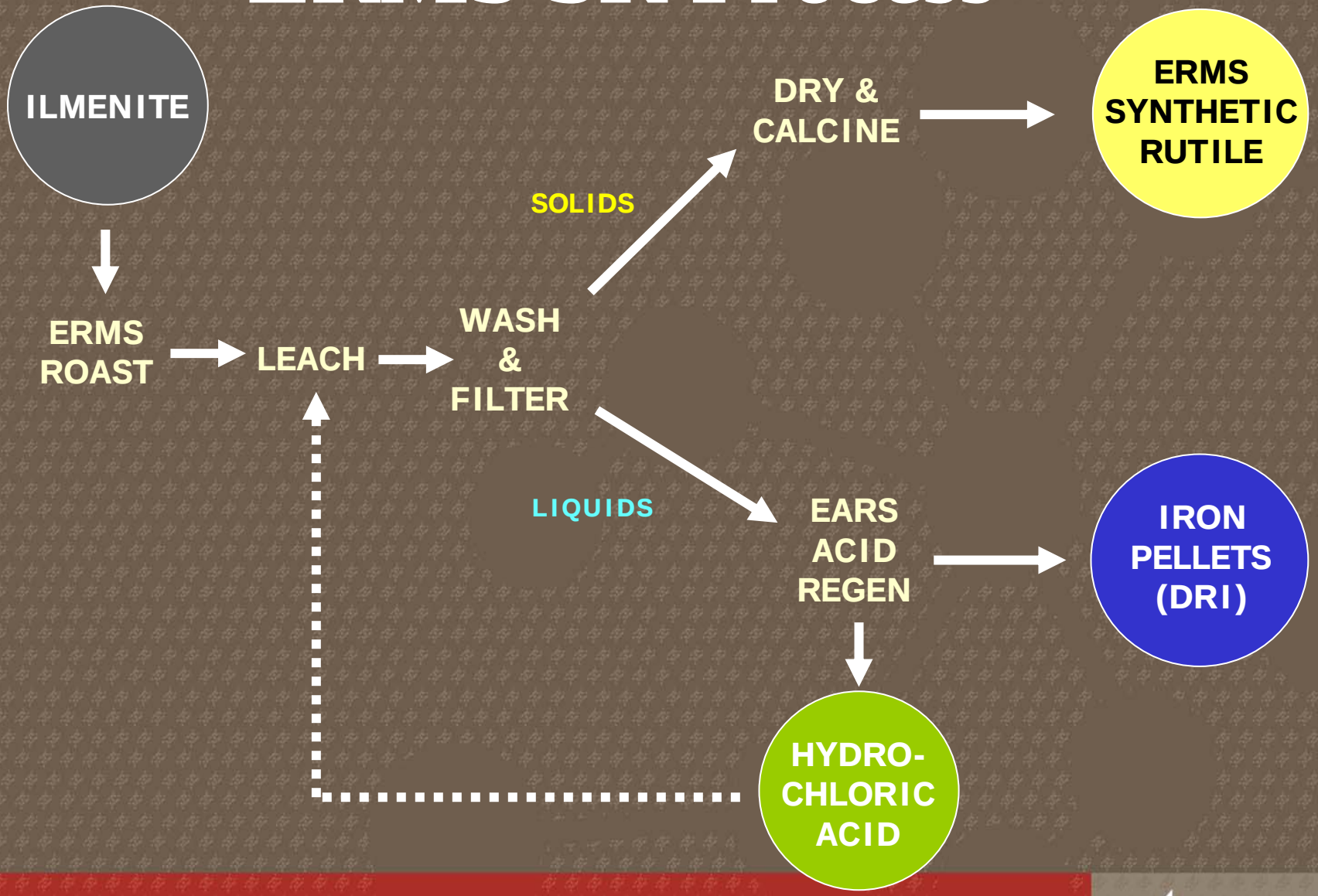
- **Direct Reduced Iron** — Simple fluid bed process to reduce iron oxide to iron metal
- **Fine Mineral Agglomeration** — Fluid bed process to agglomerate fine minerals

ERMS SR Process



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ERMS SR Process

Advantage #1

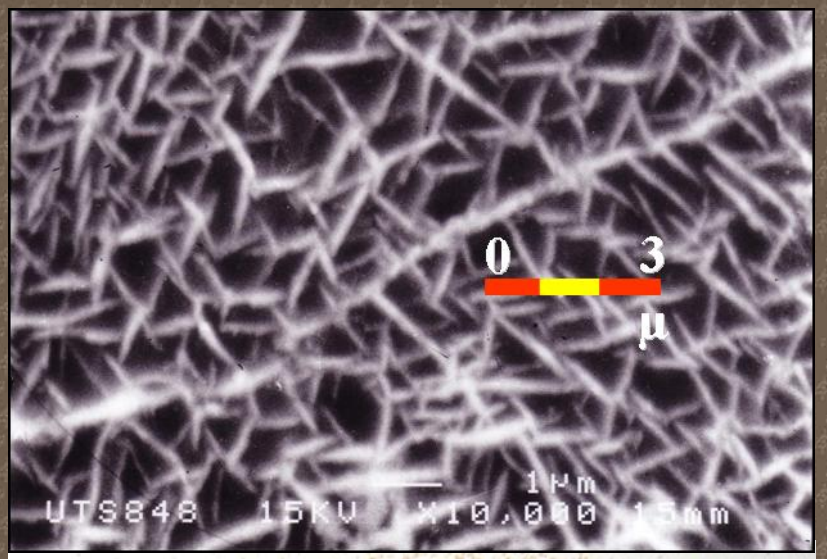
<u>Two</u> valuable products:

- **Ultra-high grade synthetic rutile**
  (for chloride pigment & metal production)
- **Iron metal pellets (DRI) for smelting to steel**
  (not fine oxide waste)

ERMS SR

Chemical Analysis

TiO_2	97.0%
Fe_2O_3	0.55%
SiO_2	0.57%
Al_2O_3	0.17%
Cr_2O_3	0.01%
CaO	<0.01%
MgO	0.02%
MnO	0.01%
U+Th	<10ppm



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Metallising EARS iron oxide

- Fluid bed reduction of EARS iron oxide pellets to iron; a new DRI process developed in batch test work
- Continuous pilot scale unit built to prove the process prior to larger scale implementation
- Process will be incorporated into EARS section of the Demonstration Plant

Pilot Scale Metalliser

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EARS Iron Pellets (DRI)

Chemical Analysis

Fe	89.7%
FeO	6.00%
TiO_2	0.16%
SiO_2	0.18%
Cr_2O_3	0.08%
CaO	0.03%
MgO	1.18%
MnO	2.29%
V_2O_5	0.84%
P_2O_5	0.007%

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Steel from EARS Fe Pellets

Chemical Analysis

C	0.002%
P	0.005%
Mn	0.01%
Si	0.003%
S	0.015%
Ni	0.05%
Cr	0.01%
V	0.001%
Ti	0.003%
Sn	0.001%

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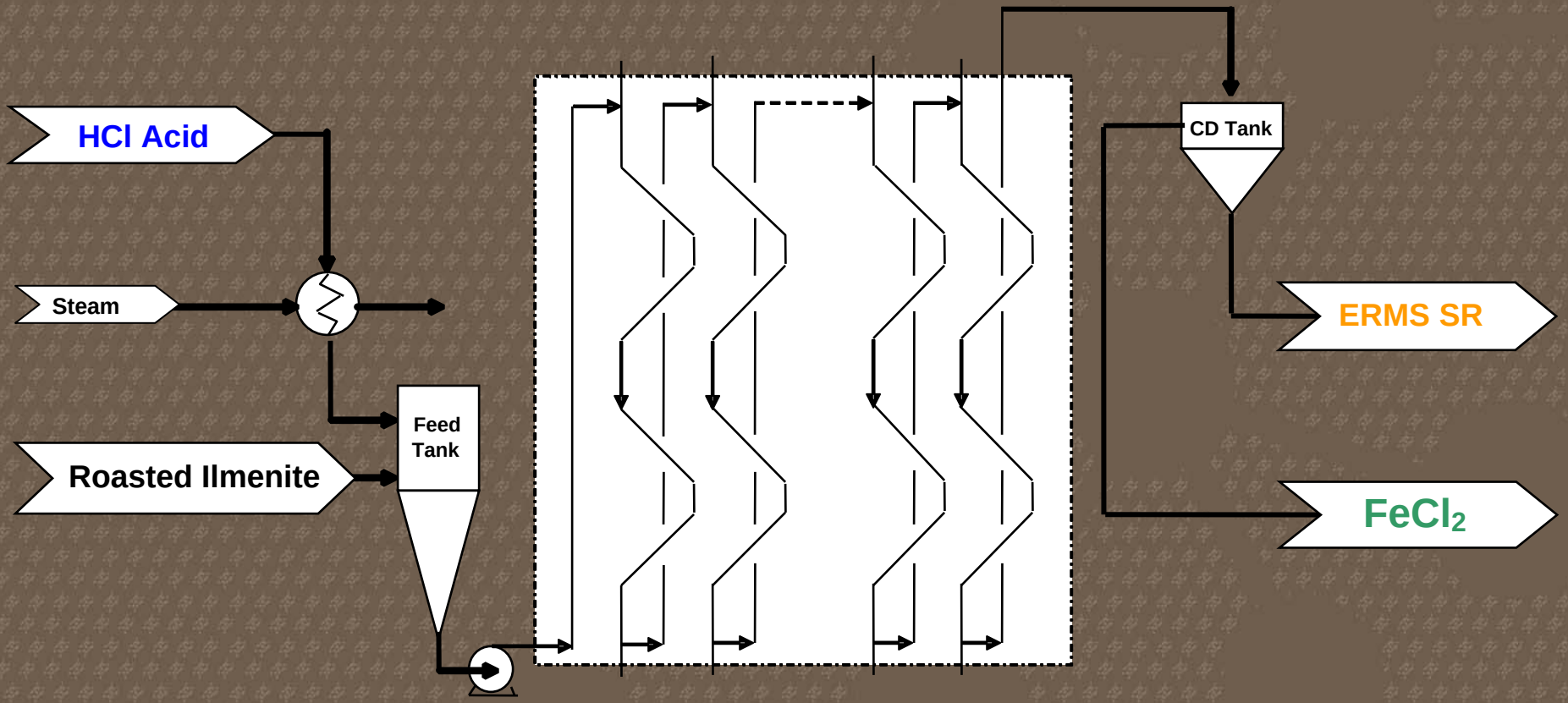
ERMS SR Process

Advantage #2

Continuous operation – therefore lower capital & operating costs

Continuous Leach Reactor



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Low Capex:

- Total plant residence time (~8h)
- No ultra high temperature equipment
- Atmospheric pressure operation
- Fully continuous process

Low Opex:

- PLC control of continuous operation
- Waste heat recovery
- Can utilise cheap fuels *(coal)*
- Produces / uses concentrated acid *(less water to evaporate)*

ERMS SR Process

Advantage #3

Versatile:

- **Non Ore Specific - can treat a range ilmenites**
- **Non Fuel Specific – can use solid, liquid or gaseous fuel *(or a combination of fuels)***
- **The process can tolerate variation in feed composition without upsetting plant operation**

ERMS SR Process Advantage #4

Low Environmental Impact:

- Fuel efficient – high revenue per unit of CO_2

Process	Products (Basis: per tonne chloride feedstock)	Gross Income / tonne CO_2 emitted
Becher SR	~91% TiO_2 SR	138
Ti Slag (thermal power)	~85% TiO_2 Slag + Pig Iron	142
ERMS SR	~97% TiO_2 SR + DRI	257

Intertech-Pira TiO_2 2007

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ERMS SR Process

Advantage #4 (cont.)

Low Environmental Impact:

- No liquid effluents
- Solids
  - Gangue minerals in feed to plant returned to mine
  - Process solids all saleable (only SR & Fe)
- Off-gas streams are thoroughly scrubbed

Opportunities

- ERMS SR
  - Production of DRI makes high iron ilmenites (< 49% TiO_2) economically viable
  - Plant location is not restricted to the resource - can be located near markets / infrastructure

Summary - ERMS SR

- Addresses sustainable development principles
- High grade feedstock assist pigment producers to:
  - lower energy costs
  - minimise environmental footprint
  - increase plant capacity

Other Opportunities

- Fine Mineral Agglomeration
- EARS acid regeneration in Steel Industry
- Direct reduction of fine iron ores

Fine Mineral Agglomeration

- Fluid bed process - no binders
- Takes the place of calcination of ERMS SR
- Produces hard, spherical particles (100-500µm)
- Particle size is self regulating

Potential applications:

- Fine grained/refractory Murray Basin deposits, Australia - e.g. WIM 150
- Fine Hi-Ti minerals
- Titania slag fines

EARS Acid Regeneration: Application in the Steel Industry

- EARS regenerates low cost HCl from waste chloride solutions from steel pickling / galvanizing operations
- Transforms iron units now lost as mill scales and dusts into high value electric arc furnace feed
- One tonne pickle liquor + two tonnes waste iron oxide = one tonne fresh acid + 1.6 tonnes iron metal
- Environmentally sound - recovers/recycles waste acids and oxides produced by steel mills

Metallisation and Iron Ore

- Value addition in the iron ore industry:
  - Reduction of magnetite sands to direct reduced iron (DRI)
  - Reduction of low value iron ore fines to high value DRI
- The continuous metallisation unit tested iron ore fines (Pilbara, Australia)
- ERMS SR Demonstration Plant will be used to process bulk iron ore samples
- Significant future potential for process

Conclusion

ERMS SR and related processes: adding significant value in the titanium, steel and iron ore industries