



# DATA SHEET No 14

## Titanium and the Environment

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### Titanium is one of the most environmentally friendly of metals.

Titanium has **outstanding resistance to corrosion** in a wide range of aggressive conditions. This eliminates or substantially reduces:

- Metal loss and energy input for repair/replacement
- Land, water or air pollution from corrosion failure of process plant
- Product contamination from metal loss or by cross stream leakage caused by corrosion
- Pollution of rainwater from run-off of roofs or cladding in architectural application

The **low weight** of titanium reduces:

- Energy loss in reciprocating equipment
- Fuel consumption in aircraft, ships and land vehicles
- Performance shortfalls in payload, range, speed and other critical factors

The total **biocompatibility** of titanium assures:

- Safe use in human bone and tissue replacement
- Harmlessness to terrestrial and marine flora and fauna
- Non-interference with microbiological processes and immunity to them

The **ability to recycle** titanium ensures:

- Maximum recovery of every form of reverted material and scrap
- Overall reduction of energy input to sustain metal supply.

### Extraction of Titanium

Although the current extraction of titanium by the Kroll Process is relatively energy intensive as compared to other engineering metals, the energy and waste savings achieved by the use of titanium represent a payback not available from less corrosion resistant, heavier, less strong and environmentally less friendly materials. The development of reduced energy extraction processes continues, most notably with the FFC electrolytic deoxidation process, which not only consumes less energy, but is also a more environmentally friendly process overall.

### Production of Titanium

Hot working of titanium metal from ingot or billet follows similar procedures to other metals, but at typically lower temperatures than for example steels or nickel based alloys. Energy consumption per weight of material processed is overall of the same order as for steel, but because of its lower density the volume of titanium product yielded is typically 30-40% greater.

### **Reclamation and Recycling of Titanium**

Titanium scrap generated in manufacturing processes and in equipment fabrication is fully recyclable. Substantial investment by titanium producers in cold hearth and other remelting furnaces has greatly improved the economy of recycling and made possible the direct use of the widest possible range of scrap forms. The sustained value of life expired titanium parts and systems should always be taken into account in life cycle cost considerations. The probability that titanium process plant and other equipment will remain both clean and free of corrosion means that re-use of the whole plant or of elements of the plant, e.g. condenser tubing, may be considered, and offer further economies in major equipment production and procurement cycles.

### **Reduced Costs of Maintenance and Replacement**

Specification of titanium from the outset for aggressive service in chemical plant, power station condensers, offshore systems and other equipment required to perform reliably in harsh operating environments has clearly demonstrated the cost benefits and energy savings which attach to greater availability and reliability, reduction of unscheduled outages, longer intervals between shutdowns for routine maintenance and longer safe life overall. Offshore systems with planned lives of up to 70 years, and with critical requirements for continuous safe performance, demonstrate in particular the low life cycle costs and high environmental benefits which result from the near total compatibility of titanium with marine environments.

### **Electrochemical Processes**

The use of titanium anodes greatly increases the environmental friendliness of electrochemical processes such as chlorine production. Titanium anodes are more stable than nickel, lead, zinc or mercury. Titanium electrode activating coatings can be replaced several times on the same titanium structure. The process efficiency (energy input per unit of product) and process control (consistency and safety) are significantly higher when titanium electrodes are used.

## FOR FURTHER INFORMATION CONTACT

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