Environmental spotlight on titanium

Titanium is one of the most environmentally friendly metals.

- In all fields of engineering, designers, production specialists and users are looking to enhance the performance of products and processes. Technical information about titanium alloys that offer enhanced strength, greater corrosion resistance and other desired properties is in greater demand than ever. Titanium, still seen by many as a newcomer in industrial application, is today offered by a large number of manufacturers and suppliers. Titanium is no longer an “exotic metal”; it is rather the fourth most abundant structured metal found in the earth’s crust, and ranks ninth in the list of the ten most important industrial metals. No other metal used in industry has acquired such an important status so quickly in a such wide range of critical and high-tech industrial applications.
- To provide you with current information about titanium and its alloys, ***Uli Glaser Design*** has secured itself the support of the Titanium Information Group (TIG).

Titanium offers outstanding resistance to corrosion under a wide range of aggressive conditions. This eliminates or substantially reduces:

- Metal consumption and energy input for repairs/replacement
- Land, water and air pollution from corrosion damage caused by the processing plants
- Symptoms of poisoning due to metal loss or through leakages caused by corrosion
- Contamination of rainwater as a result of run-off from roofs or cladding in architectural applications

The low weight of titanium reduces:

- Energy consumption through the replacement of equipment
- Fuel consumption in ships, aircraft and land vehicles
- Performance shortfalls in payload, range, speed and other critical factors

The complete biological compatibility of titanium ensures:

- Safe use in human bone and tissue replacement
- Harmlessness to flora and fauna
- No impact on microbiological processes and immunity to such processes

The ability to recycle titan ensures:

- Maximum recovery of every form of reclaimed material or scrap
- Overall reduction in energy input to sustain material supply

Titanium extraction

Despite the fact that the current method of extracting titanium using the Kroll process is relatively energy-intensive in comparison to other industrial metals, the savings in energy and raw materials as a result of using titanium present an advantage that cannot be achieved with less corrosion-resistant, heavier, less strong and environmentally less friendly materials. The development of new extraction processes with a lower energy requirement is ongoing, 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 ingots or billets is on the basis of processes similar to that of other metals, but at typically lower temperatures than for example steel or nickel-based alloys. The energy consumption per weight of material processed is on the whole of the same order as for steel, but because of its lower density the volume of titanium product yielded is typically 30-40% greater.

Recovery 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 efficiency of recycling and facilitate the direct use of a wide range of possible forms of titanium scrap. The sustained value of life of obsolete titanium parts and systems should always be taken into account in lifecycle cost considerations. The probability that titanium process plant and other equipment will remain both clean and free of corrosion means that these can be fully re-used (e.g. condenser tubing), and offers advanced efficiencies in the production of titanium equipment and in procurement cycles.

Reduced costs of maintenance and replacement

The deployment of titanium from the outset for aggressive conditions such as those encountered in chemical plants, 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 of titanium, which in turn are associated with higher levels of availability and reliability, reduction of unscheduled outages, longer intervals between shutdowns for routine maintenance and an altogether longer service life. Offshore systems with planned service lives of up to 70 years, and with critical requirements for continuous safe operation, highlight in particular the low lifecycle costs and significant environmental benefits which result from the almost 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 and 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.

Titanium in not an exotic material

Titanium – a material with unique and exceptional properties. Where other materials fail with regard to the requirement profile, titanium provides the solution.

Whether we seek to explore the depths of space, the world's deepest oceans, atomic structures or the human body, undertakings such as these would be utterly inconceivable without the material titanium.

Outstanding corrosion resistance, high strength coupled with a low density, extreme mechanical and thermal loading capacity and **tissue/skin compatibility** are amongst the key reasons for the wide-ranging use of titanium.

Titanium, the 22nd element in the periodic table of chemical elements, is not a rare natural deposit but rather the 9th most common element, accounting for 0.6% of the earth's crust.

Since the introduction of a viable and reliable method for extracting titanium from its ore in the early 1950s, a whole range of titanium base materials have been developed to cater to specific customer requirements. These can be divided roughly into two categories:

- Commercially pure titanium (c.p. Ti) composed of > 99.2% titanium, plus accompanying elements such as oxygen, carbon, iron.

- Titanium alloys, i.e. titanium containing 2 - 20% or more alloy elements such as aluminium, vanadium, tin, chromium, zirconium.

Lightweight, strong and corrosion-resistant.

The most important properties of titanium.
The table shows the main properties of titanium in a comparison with other materials:

	c.p. Ti	Ti alloys	Steels
Density [g/cm^3]	4,51	4,1 ÷ 4,8	7,8
Proof stress 0,2% [MPa]	170 ÷ 500	400 ÷ 1.400	200 ÷ 2.000
Elasticity modulus [GPa]	110	80 ÷ 115	210
Thermal expansion coefficient [10^{-6}/°C]	9	7,5 ÷ 10	11,7
Thermal conductivity [W / (m K)]	22	6 ÷ 13	65

Source: **Deutsche Titan** a company of ThyssenKrupp Stainless

After encountering a few teething problems when first working with titanium, we finally succeeded in processing this grey, unspectacular material so that it appeared astonishingly similar to the highly expensive material platinum. High-tech production techniques using CNC and traditional jewellery making have been combined in order to realise all designs. We work with this pure metal (c.p. titanium) either in its pure state or in combination with pure precious metals such as 24k fine gold or 999 pure platinium/PT960 in addition to the finest cut diamonds so that allergy sufferers can also enjoy wearing our jewellery without restrictions on their quality of life. We will produce any product for you to your specific requests and in line with technical requirements.

... allergy-free jewellery without compromises!