

Niobium for HSLA steel



TIC

Niobium (Nb)* is a rare grey metal with a number of unique and important qualities. In the periodic table it is element no. 41. The majority of niobium comes from Brazil, with Canada an important minor source.



The largest use for niobium is in **high-strength, low-alloy (HSLA) steel**, which is a crucial material for automobiles, oil pipelines and construction.

HSLA steels are also used in nuclear reactors (alloyed with zirconium to make core elements), wind turbines, railroad tracks and in ship building. HSLA steels consume approximately 90% of the annual niobium production.

Why use niobium in HSLA steel?

Since its first few applications in the 1960s it has been widely adopted and can provide spectacular improvements and cost savings.

In HSLA steel niobium is often less than 0.1% of the total alloy, but its role as a grain refiner makes a significant difference by increasing strength, weldability, ductility, and toughness of the steel.

Strength is generated by grain refinement for the lower grades and a combination of grain refinement and precipitation hardening for the higher grades.

From a metallurgist's perspective, grain refining is the reduction in size of the grains inside a material, e.g. from A to B in Figure 1.

Since only a small amount of niobium is present, these steels are also called "micro-alloyed" steels.

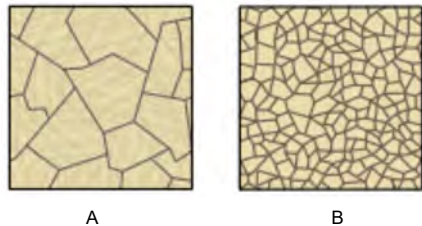


Figure 1: Metal A has not been grain refined, metal B has been.

*** Is it niobium or columbium?**

Officially, it is niobium, but columbium is still widely used in the United States.

When element 41 was first identified in 1801, it was named 'columbium' (Cb). However, for many years chemists believed it was the same element as tantalum (Ta) and when, in 1844, it was rediscovered, it was named 'niobium' (Nb). It was not until 1865 that tantalum and niobium were proven to be two elements, and columbium and niobium to be one element, but by then all three names were already in wide circulation. In 1950 the International Union of Pure and Applied Chemistry officially adopted 'niobium'.

Gas and oil pipelines

Most of the world's 3.5 million km of high pressure gas and oil pipelines contain niobium to make them safer, lighter and able to transport large volumes of hydrocarbons at higher pressures. A standard steel grade in this application is X70 which contains 0.03% niobium.



Automobiles

The demand for fuel efficient, safe and long-lasting vehicles has been a major driving force in the development of new automobiles, all of which are improved by HSLA steels.



In recent years the trend to light-weight vehicles has greatly

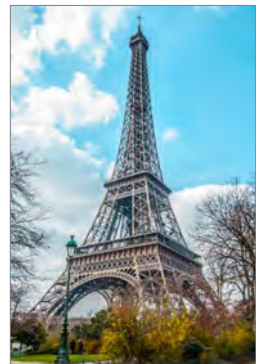
increased demand for HSLA steels containing niobium because of their remarkable weight savings. Currently, about 80% of all automotive sheet steel grades are regularly microalloyed with niobium.

Construction

The superior strength of HSLA steels means that less is needed to achieve the same result. For example:

The **Eiffel Tower** was built in 1887-89 using 7,300t of wrought iron. Today it could be built using only 2,000t of HSLA steel.

The **Millau Viaduct** in southern France (see cover image) was constructed using HSLA steel containing 0.025% niobium. This reduced the total weight of steel and concrete needed by 60% (source: CBMM).



The Eiffel Tower, Paris, France (Shutterstock)

For more information on medical uses of niobium visit www.TaNb.org.



TANTALUM-NIOBIUM

INTERNATIONAL STUDY CENTER

www.TaNb.org

The T.I.C. is the international trade body that represents the tantalum and niobium industries. We have around 90 members from over 25 countries involved with all aspects of the tantalum and niobium industry supply chain (from mining and refining through to OEMs and recycling).

OBJECTIVES

- Increase awareness and promote the remarkable properties of tantalum and niobium.
- Host the Anders Gustaf Ekeberg Tantalum Prize, an annual award that recognises excellence in tantalum research.
- Organize a General Assembly (conference) in October each year for business and technical presentations. Non-members may attend.
- Publish a quarterly Bulletin newsletter for members and stakeholders.
- Collect from the members (via an independent company to ensure confidentiality) statistics on the tantalum and niobium industries.
- Address key issues facing the industry, such as legislation, supply chain due diligence, and transport of radioactive materials (NORM).

Tantalum-Niobium International Study Center (T.I.C.)

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