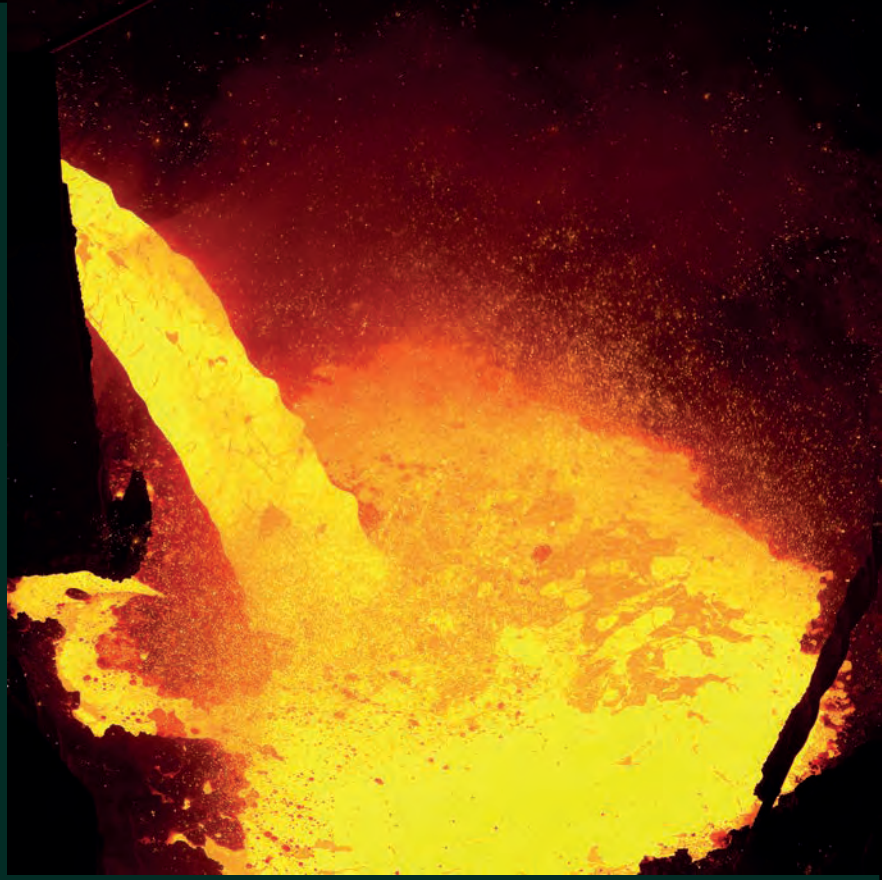
THE BENEFITS OF NIOBIUM MICROALLOYING DESIGN FOR STRUCTURAL APPLICATIONS



Niobium Nb

DISCOVER HOW NIOBIUM CAN REDUCE ALLOYING COSTS FOR 355MPa GRADE STRUCTURAL FLAT PRODUCTS

LEAN ALLOY DESIGN

It is well established that niobium adds value to many steel products, through improving the properties of the material and enhancing the performance of end products.

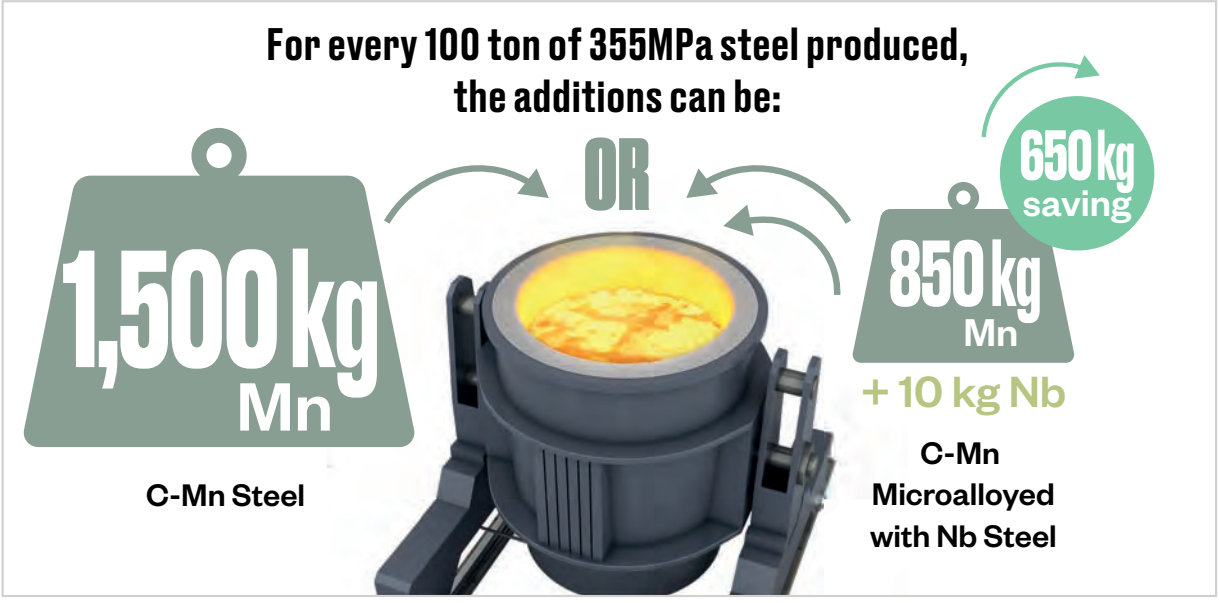
Driven by the need to become increasingly cost-competitive, niobium can add considerable value to structural steel grades up to 355MPa. It enables the design of leaner alloys, reducing the cost of production and without requiring any changes to the steelmaking or rolling mill processes.

COMPARABLE PROPERTIES WITH REDUCED COSTS

For structural flat products up to 355MPa yield strength, a small amount of niobium can be added. Just **0.01% niobium** will meet the mechanical properties required, whilst providing the opportunity to **reduce alloying costs by up to 30%** depending on the price of the ferroalloys.

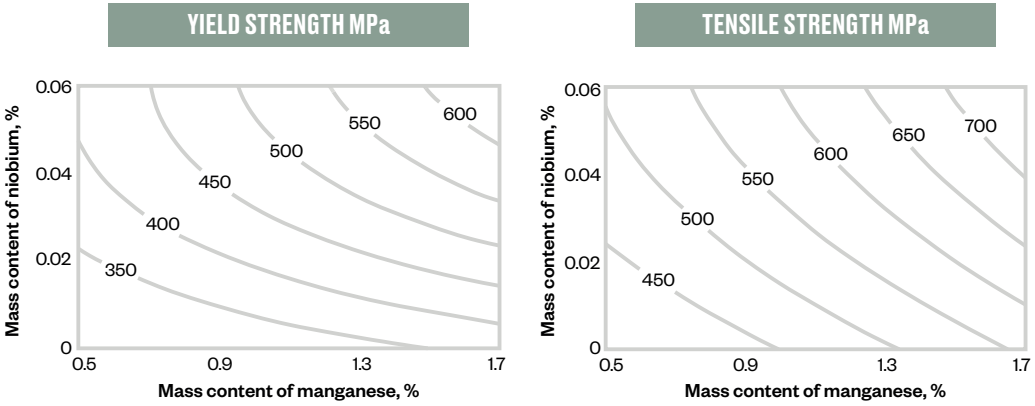
HOW IS THIS ACHIEVED?

Niobium enables the design of a 'leaner' alloy. Adding a small amount of niobium can partially replace the amount of manganese required to meet 355MPa yield strength.



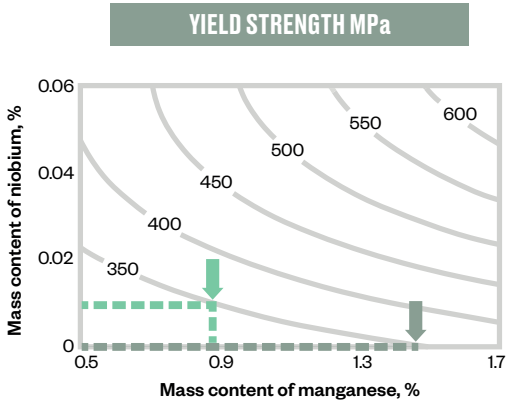
MEETING THE REQUIRED PROPERTIES

For these types of structural flat steel products, Morosov et al demonstrated that there is a strong correlation between niobium and manganese content with respect to yield strength and tensile strength. As you can see from the following figures, varying the relative amounts of niobium and manganese enables the requirements for a specific yield strength and tensile strength to be met.



Morosov, Y.D.; Stepahin, A.M.; Aleksandrov, S.V. - Effect of Manganese and Niobium and Rolling Conditions on the Properties of Low Alloy Steel, Metallurgist, 2002.
Studying 0.10%C steel, plate thickness from 8mm to 12mm.

The specific example below shows the relative amounts of niobium and manganese required to meet 350MPa yield strength.



For YS = 350MPa, you can use:

0.0%Nb + 1.5%Mn

or

0.010%Nb + 0.85%Mn

Therefore, the application of the lean alloy design using niobium to reduce the amount of manganese required, enables the mechanical properties to remain the same. Furthermore, up to 355MPa, Thermomechanical Controlled Processing (TMCP) during rolling is also not required to meet the required mechanical properties.

HOW MUCH CAN I SAVE ON MY ALLOYING COSTS?

The cost scenarios presented below, demonstrate the potential savings on alloy costs for the production of a 355MPa grade structural steel, based on current ferroalloy prices (June 2020).

ALLOY COST SIMULATOR

		Non-Nb Option	Nb-content Option
Production per Year (ton)		300,000	
Chemical Composition			
	Nb (%)	0.00%	0.010%
	Mn (%)	1.50%	0.85%
Alloy Cost Impact			
	Nb (USD)	0	1,106,526
	Mn (USD)	7,253,846	4,110,513
	Alloy (USD)	7,253,846	5,217,039

PRODUCTION SETUP

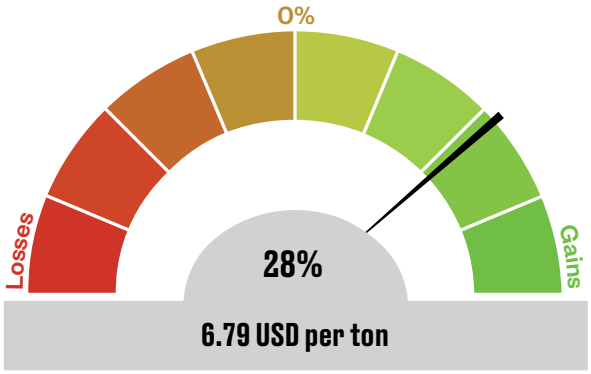
	FeNb	FeMn
Price (USD / Kg)	35.04	1.1316
% Nb/Mn Content per USD / Kg*	100%	78%
% Recovery (Yield)	95%	90%

**FeNb is sold by Nb content*

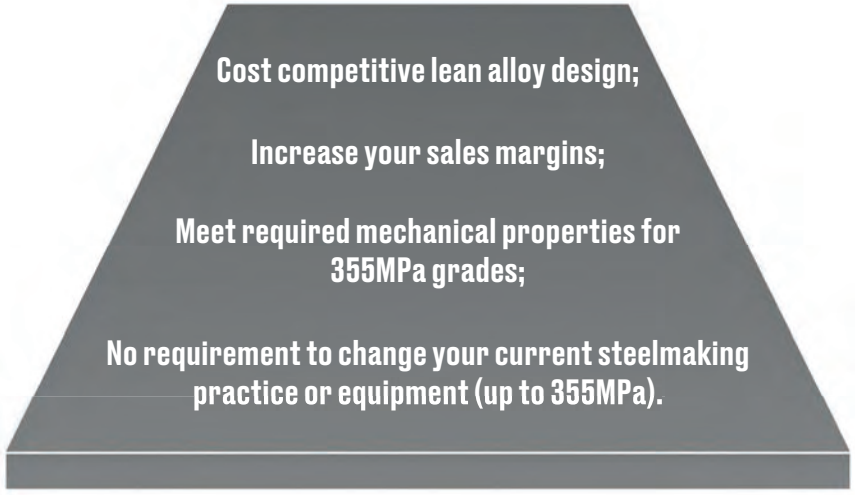
**FeMn is not sold by Mn content*

ALLOY COST IMPACT PER YEAR

2,036,807 USD



From this example, at a production level of 300,000 tons per year, you can see a saving of 28% on alloying costs, representing an actual saving of 2,036,807 USD per year.



Finally, the niobium-based lean alloy design can also be applied to higher performing steels, those with greater yield strength than 355MPa. We can use our rolling mill simulator 'MicroSim', to provide you with the optimum rolling mill process to meet your specifications for these higher performance steels. Contact us for more information.

CBMM | Niobium Nb

World leader in the production and commercialization of Niobium products, CBMM has customers in over 40 countries. With headquarters in Brazil and offices and subsidiaries in China, Netherlands, Singapore, Switzerland and the United States, the company supplies products and cutting-edge technology to the infrastructure, mobility, aerospace and energy sectors. CBMM was founded in 1955 in Araxá, Minas Gerais, and relies on a strong technology program to increase Niobium applications, growing and diversifying this market.

Further information
can be obtained at
www.niobium.tech