

MARTENSITIC

STEELS



**Bumper Reinforcement and Door
Intrusion Beams**

Rocker Panel Inners and Reinforcements

Side Sill and Belt Line Reinforcements

Springs and Clips



Cleveland-Cliffs' family of **MARTENSITIC ULTRA HIGH STRENGTH STEELS** consists of fully martensitic microstructures offering some of the highest strength levels available in the marketplace. These steels offer much higher strength-to-weight ratios than conventional cold-rolled steels and, pound-for-pound, are more cost effective than other metals or plastics. Unlike some competing materials, these grades have uniform mechanical properties in both longitudinal and transverse directions. This allows more flexibility in both design and manufacturing to maximize material utilization. Though limited in formability, alternative available manufacturing technologies, such as roll forming, are used to fully utilize these grades.

Cleveland-Cliffs offers martensitic grades with an electrogalvanized coating for superior corrosion protection.

MARTENSITIC STEELS

Grade Availability

Cleveland-Cliffs' cold-roll family of fully Martensitic Steels is offered with tensile strength grades ranging from 900 to 1700 MPa. These grades are also available in tensile strength grades from 900 to 1500 MPa with an electrogalvanized (EG) coating.

Tensile Strength	Uncoated	EG
900 MPa	yes	yes
1100 MPa	yes	yes
1300 MPa	yes	yes
1500 MPa	yes	yes
1700 MPa	yes	in development

Applications

The high strength-to-weight ratios open up many attractive weight reduction opportunities. They are designed especially for roll-formed and tubular applications where high strength is critically important. Typical applications for Cleveland-Cliffs' family of martensitic grades are: bumper reinforcement beams, door intrusion beams, rocker panel inners and reinforcements, side sill reinforcements, belt line reinforcements, springs and clips.

Chemistry

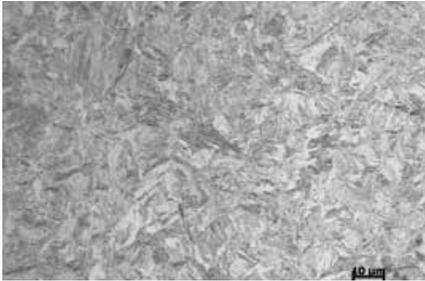
	C (wt. %)	Mn (wt. %)	P (wt. %)	S (wt. %)	Other	Form
M900	0.08	0.45	0.01	0.004	B, Ti	CR, EG
M1100	0.12	0.45	0.01	0.004	B, Ti	CR, EG
M1300	0.17	0.45	0.01	0.004	B, Ti	CR, EG
M1500	0.25	0.45	0.01	0.004	B, Ti	CR, EG
M1700	0.29	0.45	0.01	0.004	B, Ti	CR

Mechanical Properties

	Test - direction	Yield strength (MPa)	Ultimate tensile strength (MPa)	Total elongation (%)	Recommended bend radius
M900	ASTM - L	960	1070	5	4T
M1100	ASTM - L	1070	1200	5	4T
M1300	ASTM - L	1230	1390	5	4T
M1500	ASTM - L	1420	1600	5	4T
M1700	ASTM - L	1560	1750	5	4T

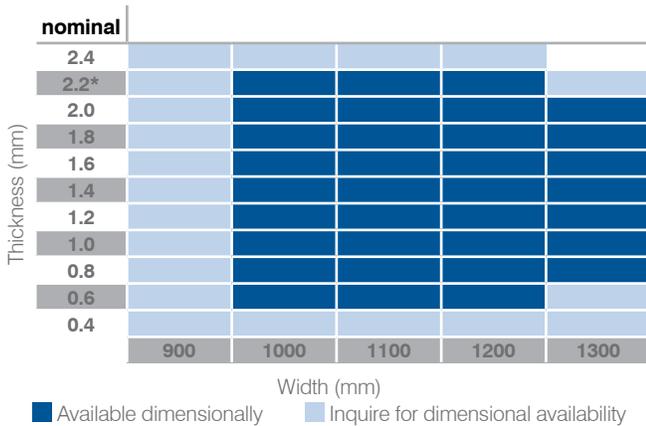
MARTENSITIC STEELS

Metallography - 100% Martensite



Magnification 1000X. M1700.
Contains 100% tempered Martensite.

Size Availability



* enhanced capability

About Cleveland-Cliffs Inc.

Cleveland-Cliffs is the largest flat-rolled steel producer in North America. Founded in 1847 as a mine operator, we are also the largest producer of iron ore pellets in North America. In 2020, we acquired two major steelmakers, AK Steel and ArcelorMittal USA, vertically integrating our legacy iron ore business with quality-focused steel production and emphasis on the automotive end market. Our fully integrated portfolio includes custom-made pellets and hot-briquetted iron (HBI); flat-rolled carbon steel, stainless, electrical, plate, tinplate and long steel products; as well as carbon and stainless steel tubing, hot and cold stamping and tooling. Headquartered in Cleveland, Ohio, we employ approximately 25,000 people across our mining, steel and downstream manufacturing operations in the United States and Canada.

CLEVELAND-CLIFFS INC.

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