

15 Cr-CbTM STAINLESS STEEL ULTRA FORM[®]



Applications Potential

AK Steel's 15 Cr-CbTM ULTRA FORM[®] is a low-carbon, low-nitrogen ferritic grade of stainless steel with an intermediate, 14.5% chromium content. Alloying additions of Ti, Cb, Si and Mn provide excellent room temperature formability and impart superior hot strength and high temperature oxidation resistance when compared to Type 409, Type 439, Type 430, 11 Cr-CbTM and Type 436. This grade's alloying additions, combined with AK Steel's proprietary ULTRA FORM[®] processing technology, yield a fine, equiaxed grain structure that enhances room temperature formability and minimizes ridging.

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The information and data in this product data sheet are accurate to the best of our knowledge and belief, but are intended for general information only. Applications suggested for the materials are described only to help readers make their own evaluations and decisions, and are neither guarantees nor to be construed as express or implied warranties of suitability for these or other applications.

Data referring to mechanical properties and chemical analyses are the result of tests performed on specimens obtained from specific locations with prescribed sampling procedures; any warranty thereof is limited to the values obtained at such locations and by such procedures. There is no warranty with respect to values of the materials at other locations.

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PRODUCT DESCRIPTION

AK Steel's 15 Cr-Cb Stainless Steel has been engineered to meet the new challenges of the automotive exhaust industry, especially in the "hot-end" of the system where temperatures may exceed 1400F. Exhaust flanges, exhaust manifolds, front pipes and catalytic converters are excellent applications. These exhaust components require good room temperature formability, and excellent high temperature oxidation resistance and hot strength.

Typical Composition

| | wt % |
|------------|--------|
| Carbon | 0.010 |
| Manganese | 1.000 |
| Phosphorus | 0.025 |
| Sulfur | 0.003 |
| Silicon | 1.300 |
| Chromium | 14.500 |
| Nickel | 0.300 |
| Titanium | 0.250 |
| Columbium | 0.350 |
| Nitrogen | 0.011 |

AVAILABLE FORMS

AK Steel offers 15 Cr-Cb in thicknesses from .015" to .100", (0.38 mm to 2.50 mm). Widths are available up to 48", 1219 mm. For other sizes, please inquire.

TYPICAL MECHANICAL PROPERTIES

ANNEALED CONDITION

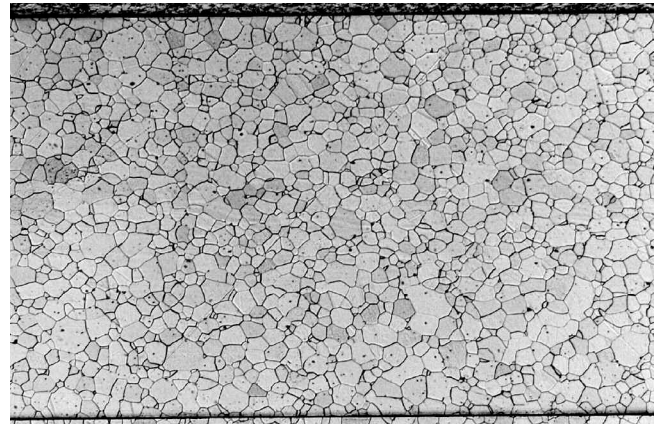
| UTS ksi (MPa) | 0.2% YS ksi (MPa) | Elongation (% in 2") | Hardness Rockwell B | r-bar | Δr |
|--------------------|----------------------|-------------------------|------------------------|---------|------------|
| 68-78 (469-538) | 45-55 (310-379) | 28-37 | 78-85 | 1.3-1.6 | 0.5 |

WELDABILITY

AK Steel 15 Cr-Cb™ ULTRA FORM® Stainless Steel can be welded using current methods for ferritic stainless steels, including Gas Tungsten-Arc (GTAW), Electrical Resistance, Electron Beam, Gas Metal-Arc, High Frequency Welding and Laser Welding Technique. Special consideration may be required to avoid brittle weld fracture during forming in cold temperature.

TYPICAL GRAIN STRUCTURE

AK Steel's 15 Cr-Cb™ ULTRA FORM® processing technology and balanced chemistry together produce a uniform equiaxed grain structure. This fine structure greatly enhances room temperature formability and minimizes ridging.



0.059" Gauge at 50X

IMPACT TOUGHNESS

The ductile-to-brittle transition temperature will be similar to 18 Cr-Cb™ stainless steel.

ELEVATED TEMPERATURE STRENGTH

High temperature strength values for a .059" thick coil are presented in the table below.

The high temperature strength and oxidation resistance of 15 Cr-Cb exceeds that of those exhaust grades typically used including Type 436, Type 444, Type 439, Type 409 and Type 18 Cr-Cb™ up to 1,500F. Hot strength mechanical properties are shown in figures 1 and 2 for yield strength and ultimate tensile strength, respectively.

| Gauge inch (mm) | Temperature °F (°C) | UTS ksi (MPa) | 0.2% YS ksi (MPa) |
|--------------------|------------------------|------------------|----------------------|
| 0.059 (1.5) | 1100 (593) | 52.1 (359) | 23.8 (164) |
| | 1300 (704) | 21.2 (146) | 15.9 (110) |
| | 1500 (816) | 6.7 (46) | 5.0 (39) |
| | 1650 (899) | 4.4 (30) | 3.2 (22) |

Figure 1: 15 Cr-Cb Yield Strength

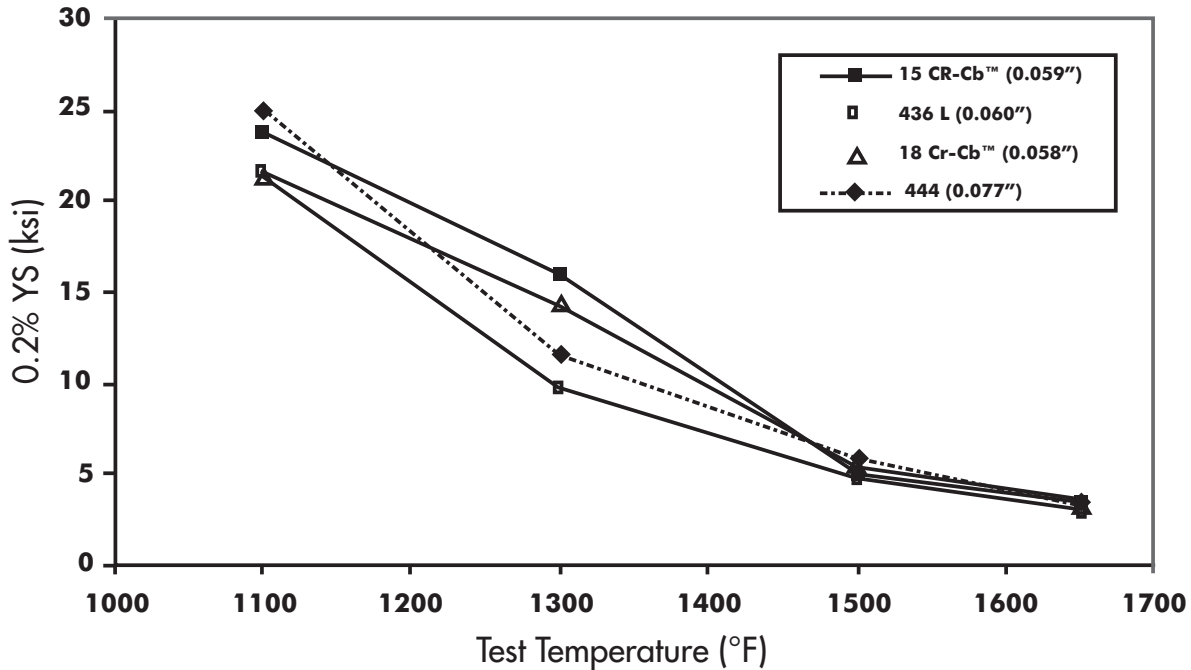
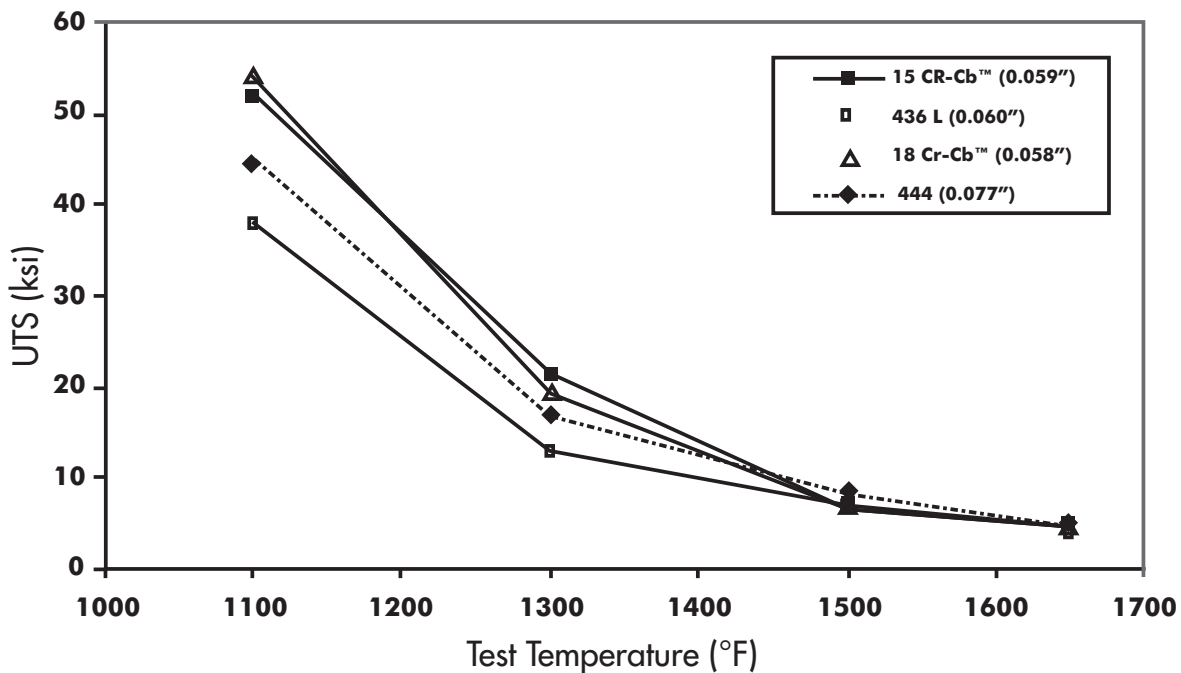


Figure 2: 15 Cr-Cb Ultimate Tensile Strength



CORROSION RESISTANCE

AK Steel's 15 Cr-Cb™ ULTRA FORM® Stainless Steel provides good wet corrosion resistance superior to 409 in moderately severe chloride and organic acid environments. 15 Cr-Cb also provides excellent resistance to corrosion in dilute sulfuric acid and in concentrated sodium hydroxide solutions.

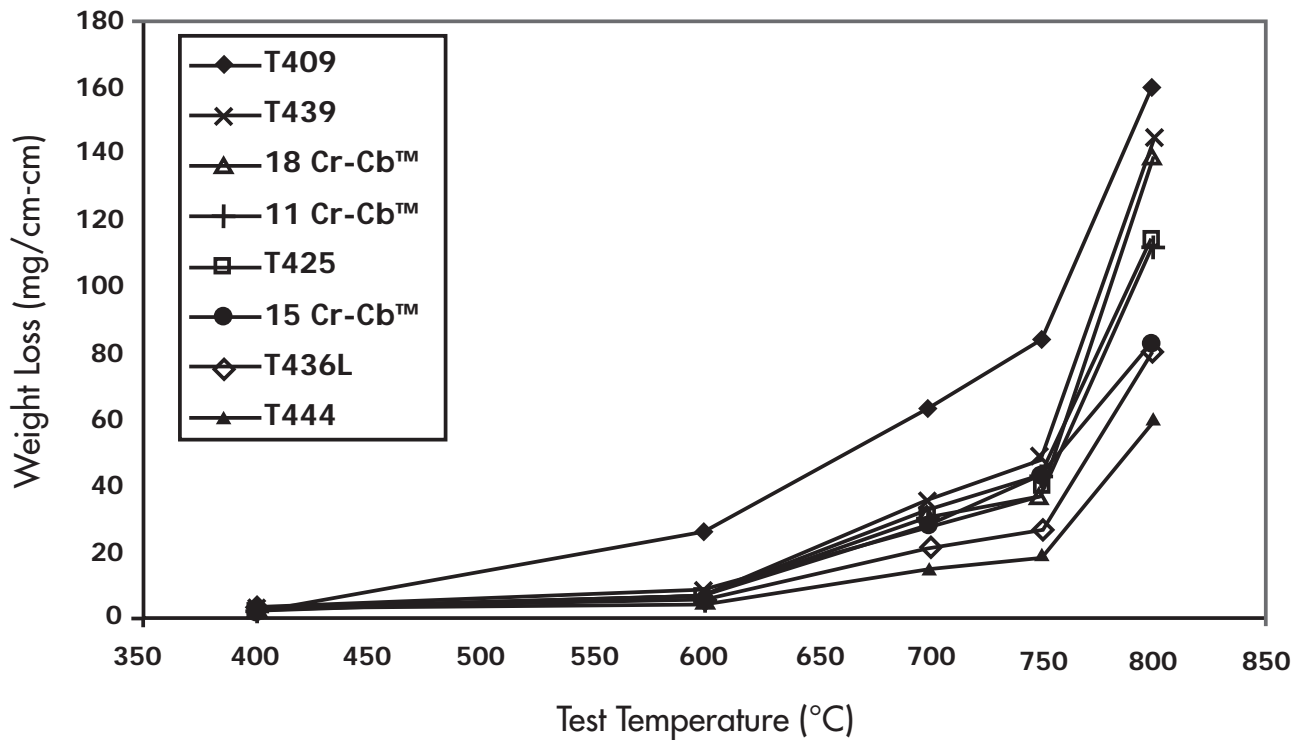
HIGH TEMPERATURE OXIDATION RESISTANCE

AK Steel's 15 Cr-Cb™ ULTRA FORM® is resistant to high temperature oxide scaling as a result of additional high silicon alloying. This product is expected to be comparable to 11 Cr-Cb™ and 18 Cr-Cb™ and should provide better oxidation resistance than Type 409 and Type 439 stainless steel. This alloy is an attractive option for exhaust manifolds and other high temperature areas of the exhaust system.

HIGH TEMPERATURE CYCLIC CORROSION

15 Cr-Cb™ ULTRA FORM® samples, along with other commonly used exhaust materials, were dipped in a 5% NaCl solution, and were exposed to various temperatures for 2 hours. After 10 cycles the scale loss was then measured in mg/cm². These values are presented in Figure 3 and show that the hot salt corrosion of 15 Cr-Cb™ ULTRA FORM® is better than Type 409, Type 439 and comparable to Type 425, 11 Cr-Cb™ and 18 Cr-Cb™.

Figure 3: Hot Salt Scale Loss



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