

Below you will find answers to the questions we get most often about ChromX<sup>®</sup>. More product information is available in the Resource Library on cmc.com, or you can contact your regional sales representative who will be happy to help answer your questions.

### General Questions

#### What does ChromX<sup>®</sup> stand for?

The product brand name, ChromX<sup>®</sup>, combines the alloying element, ferrochrome or chrome, with the “X” adopted as a symbol for steel. While only one element of the process - ferrochrome - plays an important role in the production of ChromX<sup>®</sup> steels, our products are produced through a combination of steel alloys and controlled manufacturing processes.

#### How long have ChromX<sup>®</sup> products been on the market?

The initial production of ChromX<sup>®</sup> steel reinforcing bar was in 2001. It has been a leading corrosion-resistant, high-strength steel in the market since 2002.

#### Is ChromX<sup>®</sup> steel proprietary?

ChromX<sup>®</sup> steels are proprietary but are sold under a general non-proprietary specification. To support the use of innovation by state and federal departments, the FHWA published a new federal rule on September 27, 2019 that gives states more flexibility in the selection of products used in federal-aid highway projects.

There is no other uncoated product like ChromX<sup>®</sup> on the market today offering the corrosion resistant properties, high strength and ductility along with the benefits derived from these properties. Therefore, state transportation departments can certify that there is no equally suitable alternative.

#### How is ChromX<sup>®</sup> produced?

ChromX<sup>®</sup> is produced with recycled materials through a combination of alloy additions and a controlled manufacturing process. The combination of the steel's chemical composition and production process develops the unique microstructure of the steel that drives the advantageous product properties. ChromX<sup>®</sup> steel bars are manufactured by CMC at CMC Steel in Cayce, South Carolina, and by Cascade Steel Rolling Mills, Inc. in McMinnville, Oregon.

#### Does ChromX<sup>®</sup> weigh the same as standard rebar?

Yes. ChromX<sup>®</sup> weighs the same for similar lengths and diameters.

### Specification And Engineering Questions

ChromX<sup>®</sup> 2000, 9000 and 4000 Series are produced in full accordance to ASTM International – ASTM A1035 (2020), Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement, Grades 100 and 120 types CS, CM, respectively. ChromX<sup>®</sup> series meet and exceed ASTM A615-20 Grade 100

#### What is the alloy content of ChromX<sup>®</sup>?

ChromX<sup>®</sup> is a low-carbon, chromium alloy steel bar. ChromX<sup>®</sup> 9100 and 9120, 4100 and 4120, rebar shall meet the requirements of Table 1 as per ASTM A1035-20.

Alloy Type	Carbon	Chromium	Manganese	Nitrogen	Phosphorus	Sulfur
<b>A1035 CS ChromX<sup>®</sup> 9100 and 9120</b>	0.15%	8.0 - 10.9%(A)	1.5%	0.05%	0.035%	0.0455%
<b>A1035 CM ChromX<sup>®</sup> 4100 and 4120</b>	0.20%	4.0 - 7.9%	1.5%	0.05%	0.035%	0.0455%

(A)AASHTO M 334 M/M 334 - 17 has a minimum 9.2% Cr content.

## Specification And Engineering Questions

### **How do engineers specify ChromX®?**

ChromX® 9000 and 4000 products can be specified as reinforcing bars conforming to ASTM A1035-20 respectively, along with the grade designation (100 or 120). For highways and bridge applications, according to AASHTO, ChromX® 9100 products can be specified as low chromium reinforcing bars conforming to AASHTO M 334 M/M 334 along with the grade designation (100).

### **How do engineers design with ChromX® Grade 100? Are there guidelines designers can refer to?**

Engineers shall comply with applicable building codes by cities, counties and states, ACI 318 and IBC 2009, 2012, 2015 and 2018. In addition, designers shall be guided by the ACI 439-6R-19 and ICC ESR-2107, which provide design guidelines on the use of ASTM A1035 up to 100 ksi yield in structural designs. The AASHTO LRFD Bridge Design Specifications also provides guidance for designing bridges up to 100 ksi yield strength.

Additionally, we offer design guidance and assistance to engineers when they are faced with unique structural challenges. Our experienced sales team can collaborate with your engineers to mitigate construction challenges and improve constructability with cost-competitive, innovative solutions.

### **Can engineers design with ChromX® in accordance to the International Building Codes (IBC)?**

ICC ESR-2107 provides design guidelines on the use of ASTM A1035 up to 100 ksi yield in structural designs in accordance to the Acceptance Criteria ICC AC429, thereby conforming to the requirements of IBC 2009, 2012., 2015 and 2018.

### **Can engineers design with ChromX® in accordance to the American Concrete Institute (ACI)?**

In 2019, the ACI published the ACI 318-19 which includes the design code requirements for using ASTM A1035 Grade 100 in all gravity loads. In addition, in 2019, the ACI published the ACI 439-6R, Design Guide for the Use of ASTM A1035/A1035M Grade 100 Steel Bars for Structural Concrete, which guides engineers to safely design with ASTM A1035/A1035M at a yield strength of 100 ksi.

### **Can engineers design with ChromX® in accordance to the Canadian Standards Association (CSA)?**

Currently, there are no Canadian specifications and standards that cover the ChromX® products or their use in concrete design. The numerous Canadian projects where that ChromX® has been used have been constructed to ACI, ICC-ES or AASHTO design standards or standards specific to agencies in a province.

### **Does AASHTO allow the use of ChromX®? What strength does AASHTO allow?**

Yes, the American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications, 9th Edition 2020, allows the use of steel reinforcing bar up to 100 KSI (690 MPa). Therefore, all ChromX® series that are certified in accordance to ASTM A1035/A1035M and/or AASHTO M334 M/M 334 are allowable.

### **Is there test data available to prove ChromX® 9000 products will last 100 years?**

Numerous independent third-party testing studies, such as universities and state DOTs, have found ChromX® 9000 products provide a service life of over 100 years. Given that many of these studies were written prior to our product line expansion, they often mention MMFX2 when referring to the ChromX® 9000 series.

### **How does one determine the developing length of ChromX® rebar?**

When designing per ACI 318-19, the process for determining the development length of ChromX® ASTM A1035/A1035M CS and CM Grade 100 rebar is consistent with conventional reinforcing steel Grade 100 as per sections 24.4.2.3 or 25.4.2.4 using the modification factors of section 25.4.2.5 of the latest ACI 318-19.

When designing per ACI 318-14, ACI 318-11 or ACI 318-08, the ACI 439-6R-19 recommends determining the development length of ChromX® ASTM A1035/A1035M CS and CM Grade 100 rebar to be calculated using the relevant ACI development equation provided it is properly confined. Alternatively, for both confined and unconfined spliced bars, equation recommended in ACI 408R with revised strength reduction factor,  $\Phi$  of 0.80 instead of 0.82 used by ACI 408R is recommended.



## Specification And Engineering Questions

### **If builders have a rebar congestion issue, can ChromX® help?**

Yes. One of the major benefits of ChromX® steel is the high-strength properties and the potential to help reduce rebar congestion. Using Grade 100 or Grade 120 reinforcing steel can reduce rebar requirements from 20 – 40 percent over Grade 60 reinforcing steel.

### **Is ChromX® more brittle due to its high strength?**

ChromX® steel bars have the same minimum ductility as conventional steel bars (Grade 80 and 100) due to its microstructure. There is no compromise between strength and ductility. Each size produced from the heat (batch) of steel, receives a bend test per ASTM and the results are recorded on the certified material test report (MTR). Unlike other conventional high strength steel bars, ChromX® steel bars provide a minimum T/Y ratio of 1.25 vs 1.10 for other steels.

w

### **Can ChromX® products exceed the bend requirements of ASTM A615? Can they be field bent?**

Engineers follow the ACI 318-19 and ACI 439.6R (when designing using ACI 318-14, ACI 318-11 or ACI 318-08) on minimum bending diameter requirements. The same applies to conventional black steel. ChromX® rebar can be field bent per ACI 318, which prohibits heat bending and bending bars embedded in concrete. Heat bending is prohibited, because heat can adversely impact the high-strength and the high-corrosion resistant properties of ChromX® steel reinforcing bars.

### **Can ChromX® be welded?**

ACI-439-6R Sec 10.4 restricts welding, but it also refers designers to ASTM A1035 Note 2 that states welding should be approached with caution.

### **Can ChromX® be threaded?**

Yes. ChromX® can be rolled and cut threaded.

### **Is ChromX® referenced in the U.S. Army Corps of Engineers Guide Specifications?**

Yes. ASTM A1035 is referenced in USACE Unified Facilities Guide Specifications, Division 03 – Concrete, Section 03 20 00.00 10, Concrete Reinforcing.

ChromX 2100 is only produced by Cascade Rolling Mills upon inquiry. A minimum order quantity of 300 Tons is required.



We're CMC. You'll find our products strengthening and reinforcing the infrastructure nearly everywhere on the planet – in sports stadiums and public buildings as well as highways, bridges, railways and other structures. To serve this global market, CMC maintains facilities across the United States, Europe and Asia. These sites include everything from local recycling centers, steel mini-mills and micro-mills to large-scale fabrication centers, heat-treating facilities as well as other operations.