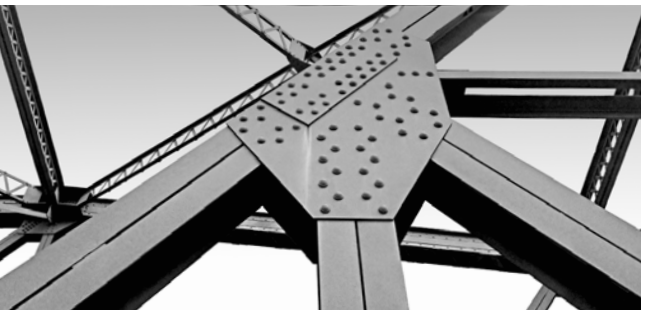
ACUREN

Knowledge Base

WHAT YOU NEED TO KNOW IF YOUR PROJECTS USE STRUCTURAL STEEL

A HIGHER LEVEL OF RELIABILITY®



INTRODUCTION

The Canadian Institute of Steel Construction (CISC) and Canadian Precast/Prestressed Concrete Institute (CPCI) have recently highlighted concerns related to structural steel procurement and the boron content in carbon steel.

https://cisc-icca.ca/global-standards-scramble-to-react-to-non-conforming-material-2/

FINDINGS FROM CISC

Steel is being supplied by mills from around the world, whether it is to the North American Standards or other standards. Reports of severe non-conformity, fraudulent mill test reports and material that contains elements not normally expected or controlled by the material standard seem to be rampant and increasing. This problem is applicable to rebar as well as to structural steel. Countries around the world have already responded to this problem through changes to their standards and by adding new ones. In North America, material standards are lagging the world in addressing serious material conformity issues. In Australia, the influx of Chinese structural steels, combined with an increase in weld failures and weld cracking, led to the discovery that the parent steel material, with high levels of boron, was the cause in many cases.

WE CAN HELP

ACUREN HAS SEVERAL LABORATORY LOCATIONS ACCREDITED TO ISO 17025.

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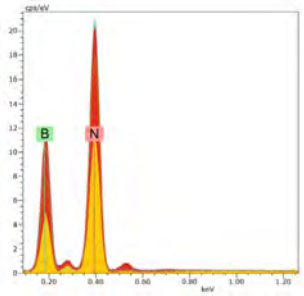
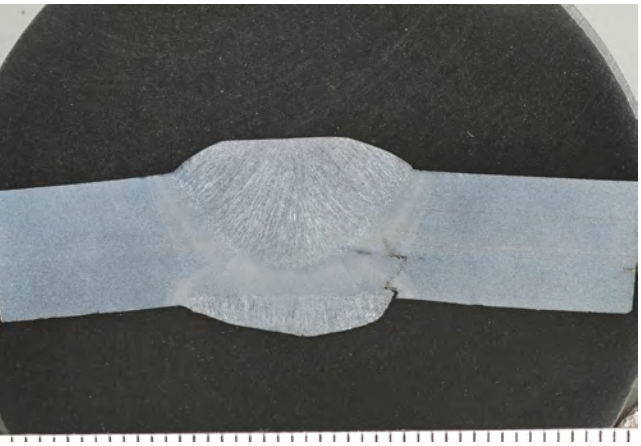
KNOWLEDGE BASE

EFFECT OF BORON ON MATERIAL PROPERTIES



Boron is added to fully killed steel to improve hardenability. Boron-treated steels are typically produced to a range of 0.0005 to 0.003%. Boron is not typically added to structural grade steels, nor are the levels (max) in Standards typically controlled or specified. Mills would not typically add boron to structural grade steels due to cost.

A very small amount of boron has a significant effect on hardenability and weldability. One of the reasons for the difference in material properties with boron content, is the different metallurgical phases that are promoted with increasing boron content. This effect of boron seems to be due to its ability to segregate at austenite grain boundaries and inhibit the grain boundary nucleation of ferrite. Therefore, it delays the formation of ferrite relative to the formation of lower temperature transformation products (martensite and bainite).



Hardness, tensile strength and yield strength increase with elevated boron concentrations. However, elongation and impact properties (in the form of Charpy V-Notch absorbed energy values) can be compromised with elevated boron contents. Brittle fracture modes over ductile can be favored with higher concentrations of boron. In the case of structural steel welds containing elevated levels of boron, various crack mechanisms can occur, including cold cracking, hot cracking, and stress-corrosion cracking.

Acuren Group Inc.

Acuren provides state-of-the-art non-destructive testing, inspection, engineering, rope access enabled industrial services delivered through over 80 locations throughout North America. Acuren has several Laboratory locations accredited to ISO 17025. Acuren's laboratories can:

- Determine the chemical composition of a material (spectral analysis for various elements including boron).
- Measure the mechanical properties of a component (tensile test, hardness, Charpy Impact, and more).
- Verify products against their Material Test Reports.
- Determine conformance of a product to its specification, material standard, code or standard.
- Provide field inspection services and non-destructive testing of products and components.
- Provide engineering services and analysis in the event of a failure.

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