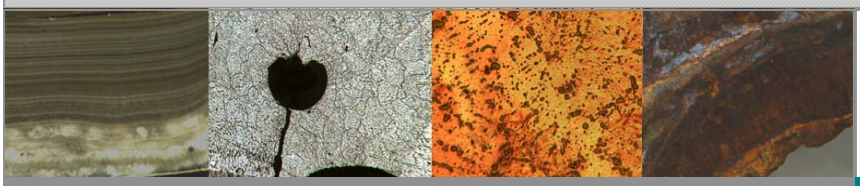
NUTS & BOLTS



New Hampshire MATERIALS LABORATORY, INC.
Your Problem Solving Partner

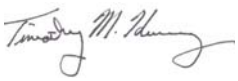
4140 Steel (Molybdenum And Chromium elements)

AUGUST 2010 / SUPPLEMENT ISSUE

Welcome to New Hampshire Materials Laboratory

As summer is coming to end, NHML is proud to announce; we will be offering supplement issues of the Nuts & Bolts to our customers. All due to the transformation of the Nuts & Bolts to an e-newsletter.

Recently, we have seen an increase interest in 4140 heat treatment and chromium plating along with links to some previous Nuts & Bolts articles published by Fred Hochgraf on these two matters.



Tim Kenney
Laboratory Director

What Do Molybdenum And Chromium Both Have In Common?

These elements are the major alloying elements in 4140 steel. 4140 steel is used in a tremendous number of applications including bearings, nuts and rings, and hollow shafts. A significant portion of the hardenability of 4140 is due to the use of the elements of molybdenum and chromium.

Today, we are highlighting the use of molybdenum and chromium in 4140 steel. Both molybdenum and chromium are group 6 elements. Chromium being the first element found in group 6.

Chromium: The solubility of chromium in alpha iron is essentially infinite. In addition of up to 1% it provides a moderate contribution to hardenability. Chromium increases corrosion and oxidation resistance, provides a moderate increase in elevate temperature strength, and with high carbon contents it can provide increased abrasion resistance.

Molybdenum: The maximum solubility in alpha iron is about 32% and about 8% in austenite.

In This Issue

Quick Links

Services

Capabilities

Resources

Be sure to review our **industry definitions** if you need assistance with terminology

Join Our Mailing List

Have You Ever Wondered What The US Penny Was Made Of?

(Fun Facts From US Mint)

US Penny

→

Molybdenum provides a significant contribution to hardenability when in solution and is a strong carbide former. Molybdenum also increases strength at elevated temperatures, creep resistance, and corrosion resistance.

4140 can be further hardened by heat treatment.

What is heat treatment?

Heat treatment is a method used to alter the mechanical and sometimes chemical properties of a material. Heat treatment involves the use of heating or chilling, to achieve a desired result such as hardening or softening of a material. Heat treatment techniques include annealing, case hardening, precipitation strengthening, tempering and quenching.

For further information on heat treatment and steels visit our website and red **"A Design Engineer's checklist: Know Your Steel & Heat Treatment"** written by Fred Hochgraf and published in the Nuts & Bolts, Volume 7

"Chrome" And " Chrome Plating"

Chrome is a slang used for the natural element Chromium. Chrome is a metal that is not useful by itself. When you hear that something is made up of chrome, what is really meant is there is a thin layer of chrome or a plating of chromium on the object. Typically the majority of the object is made up of steel, occasionally aluminum, brass, copper, plastic, or stainless steel. The chromed layer can be decorative, provide corrosion resistance, ease cleaning procedures, or increase surface hardness.

Industrial chromium plating, a.k.a. hard chrome or engineered chrome, is used to reduce friction, add wear resistance, or increase corrosion resistance. For further information on hard chrome visit our website www.nhml.com and read **"Hard Chromium Plating"** written by Fred Hochgraf and published in the **Nuts & Bolts, Volume 10.**

Fun Facts From US Mint Cont.

From 1793 to 1837 the composition was pure copper.

From 1837 to 1857 was made of bronze (95% copper & 5% of tin and zinc).

From 1857 the cent was 88% copper & 12% nickel and was bronze again from 1864 to 1962.

With a special note the coin's composition changed to steel for the year of 1943 due to the war effort. Although, a few copper pennies were produced.

In 1962, the cent's tin content was removed making the composition of 95% copper & 5% zinc and remained the same until 1982.

The composition changed in 1982 to 97.5% zinc and 2.5% copper (copper-clad zinc), and remains the same today.

For more fun facts:

US Mint Fun Facts

1877 US Coin

New Hampshire Materials Lab
www.nhml.com • lab@nhml.com • info@nhml.com
Tel: 800-334-5432 or 603-692-4110 • Fax: 603-692-4008