

# Moly goes to the races

A race car's skeleton and many of the forged components, that keep its engine running at top speed, are made of chromoly steel. Even though these grades have been around for many decades, and numerous new materials have been developed since, they still are the materials of choice in critical applications. Molybdenum is therefore a vital component to a racing team reaching its ultimate goal – the winner's circle.

Only a few years after the invention of motorized vehicles, the first road race was established. From there car racing quickly turned into an organized sport, moving to dedicated race tracks. Today there are many branches – formula racing, dirt-track racing, drag racing, go-kart racing, and even racing on frozen lakes with nail-studded wheels, to name but a handful. However, it is likely that none of the popular racing forms has such a colorful history as the sport of stock-car racing.

## The birth of stock car racing

The origins of stock car racing can be traced back to the Prohibition era in the U.S.. Soon after the law came into force, 'speakeasies' (underground clubs and entertainment venues) came into vogue. Proprietors of the 'speaks' resorted to black-market 'moonshiners' in rural areas of the country, especially the South, to distill their liquor; they then needed 'bootleggers' to transport it.



Many chromoly components, including suspension and steering parts of a race car, keep the car on course and provide for a smooth, stable ride. © Daniel Huerlimann-BEELDE/Shutterstock, Inc.

**“Moonshiners put more time, energy, thought, and love into their cars than any racer ever will. Lose on the track, and you go home. Lose with a load of whiskey, and you go to jail.”**

Junior Johnson, NASCAR legend, and one time whiskey runner

Bootleggers developed a distribution network of drivers who used their own vehicles to deliver liquor without the knowledge of authorities. Drivers modified their 'stock' cars to increase speed, improve handling and expand cargo space. The ensuing cat-and-mouse games with police spurred them to

continually increase their cars' capabilities, while retaining their outward look, in order to avoid arrest. The great Prohibition experiment ended in 1933, but the passion for speed of the bootleggers found a new outlet in organized races. By 1947, stock car racing had become so popular that the competitors founded a

formal governing organization with standardized regulations and an official racing schedule, the National Association for Stock Car Auto Racing (NASCAR). Today, NASCAR racing is one of the most popular spectator sports in America.

## Obtaining the competitive edge

Following in the footsteps of their predecessors, today's design engineers constantly work to gain an edge on the track. It doesn't matter whether the object of attention is a top-tier NASCAR, a Formula 1 or even a drag car racing team with local sponsors. All face the same problems and strive to





NASCAR teams are making adjustments to their cars.  
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solve them in ways that give their team a competitive advantage. They use a myriad of materials to make cars faster, stronger, lighter, more aerodynamic and most importantly, safe!

provide the base of support for the motor, transmission and suspension system. In addition to being light and strong, the chassis must resist the incessant vibration and high temperatures generated

They also lend rigidity, strength and stability to the chassis. The materials chosen for such an important structure cannot fail under the extreme impacts that occur in high-speed accidents.

**“Auto racing, bull fighting, and mountain climbing are the only real sports ... all others are games.”**

Ernest Hemingway

No single material can satisfy all the demands expected of every race car component. However, the AISI (American Iron and Steel Institute) 41xx grades of molybdenum-alloyed steels meet the challenge for many applications with their unique set of properties. They include strength, toughness, weldability, workability and resistance to fatigue, wear, heat, oxidation, and scaling.

during a race. Most frames are custom-built using round, oval or square tubing or I-beam shapes for rigidity.

Its superb ductility, flexibility, bendability, and weldability make 4130 chromoly a popular choice also for roll bars and roll cages. The combination of high strength and toughness helps to protect the driver without adding a lot of weight.

### Chromoly components keep the car on track

The suspension system must provide stability and good handling while reducing vibration and noise. It keeps the vehicle planted firmly on the track while supporting the car’s weight.

### Call it chromoly

The chromium and molybdenum additions in the 41xx grades spawned a well recognized name in the industry – chromoly (AKA Chrome-Moly or CrMo). The 4130 grade is most popular. Originally used by the aeronautics industry and bicycle manufacturers, it is also a favorite of race car designers and fabricators. The alloy is used in sheet, forging, and tubing product forms. Chromoly grade 4140 is particularly important for forged applications such as engine and suspension parts because of its excellent tensile strength due to the higher carbon content.

Racing’s governing bodies hold frame designers to strict standards. Nearly all frames are fabricated from 4130 chromoly because the alloy offers a



The roll cage inside a NASCAR vehicle is designed to protect the driver in case of an accident. © Sean Klingenhoefer

### Compositions of chromoly steels by weight

AISI grade	Cr (%)	Mo (%)	C (%)
4130	0.80-1.10	0.15-0.25	0.28-0.33
4140	0.80-1.10	0.15-0.25	0.38-0.43

better strength-to-weight ratio and higher ductility than carbon steels. It therefore can be used in thinner sections without loss of structural strength, reducing the weight of the car and increasing its speed. Its performance on the track more than compensates for its higher cost.

Steering components, tie rods, struts, springs, and linkages are often made from chromoly alloys because of their strength, toughness and wear resistance.

### The engine is the heart of the car

A race car’s engine produces massive amounts of power that must be maintained for hours over long distances. For example, a Formula 1 engine runs at nearly 20,000 rpm. This generates friction that can produce excessive heat and wear on its moving parts, and

### The chassis is the base

To produce a winning car, design engineers start with the chassis. It must

### Protecting the driver

Safety is of the utmost importance in the racing industry. Roll bars and roll cages are integrated with the car’s frame to protect drivers in case of accidents.



Even Formula 1 racing teams rely on chromoly steels for roll bars to protect the drivers from injury. © Natursports/Shutterstock, Inc.

extremely high mechanical stresses on all its components. High-performance engine manufacturers chose chromoly alloys for crankshafts, gears, pistons, and flywheels because of their strength, toughness, and resistance to heat, fatigue and wear.

While no single material meets the host of demands placed on components of high-performance race cars, molybdenum-containing alloys can be found throughout these vehicles. Their broad spectrum of attractive mechanical and physical properties is due in no small part to molybdenum. Even though they have been around since the 1920s, they are still critically important to racing teams today in achieving their ultimate goal – racing straight into the winner’s circle! (RB)