REAL CHROME
is the Only True Chrome

KENTUCKY CHROME WORKS

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Cars and chrome have been linked together for decades. Reaching its peak in the flamboyant styling of the 1950s, chrome wheels, trim, and accents have historically been used by car designers to help impart a distinctive look to their cars.

In the 1980s exterior chrome virtually vanished, in part due to fashion and styling changes and weight reduction efforts for fuel efficiency, but also because of concerns over quality. There were significant problems seen with premature corrosion, a problem frequently encountered as a result of the inadequate plating practices and limited technology available in the 1970s.

In the 1990s exterior chrome made a comeback, first on trucks and SUVs, and shortly thereafter on upscale cars. Since the majority of automobile manufacturers did not offer all the chrome accessories consumers wanted, a thriving after-market business developed to service the high demand. It did not take long for automobile manufacturers to recognize the demand and begin offering chrome plated wheels, trim, and accessories to distinguish their vehicles. The quality of the decorative trim put on their vehicles needed to meet the demanding performance criteria established by the car companies. They recognized that substandard chrome plating could compromise the quality of their products.

Fast forward to current day...
Advances in plating technology have made it possible to dramatically improve the performance of chrome plated parts compared to what was commonly seen in the 1970s and 1980s. Dramatic improvements in corrosion resistance evolved throughout the 1990s. Today the performance of real chrome is light years better than it was in the heyday of chrome.

Today's OEMs offer a wide array of lesser bright trim accents. None of them match the luster and performance of today's real chrome. On aluminum alloy wheels alone, there are several distinctive lesser options.

But there is only one real chrome. The most distinctive and popular option of the discerning consumer is the real chrome plated aluminum alloy wheel.

Lesser Bright Accent	Issues
Bright Machined	Normally clear coated or bare aluminum
Polished	No protection, prone to oxidation, high maintenance
Chrome Clad	POP (plating on plastic) Glued on hubcap, issues with attachment, looks cheap.
PVD	Not yet approved by all OEMs; vacuum metalizing on steroids, poor impingement performance, looks wet or sprayed on, looks cheap

Meeting the OEM performance criteria for these wheels is a task that requires a great deal of effort. Kentucky Chrome Works is the only US based plater certified to OEM specifications.

We polish and chrome plate alloy wheels manufactured by any Tier 1. We have a "dealer direct" program wherein we take in new painted alloy wheels (with no or very low mileage and no road damage); have the paint non-chemically stripped, polish and plate the wheel to OEM specifications.

Producing an OEM wheel from raw aluminum ingots to finished product involves many different stages. In simplified form, the stages are below:

PRE-PLATE

1) Casting
2) Heat treatment
3) Machining

PLATE

4) Polish
5) Pretreatment
6) Copper Buff
7) Plate

Pre-plate operations such as casting, heat treatment, and machining can have a tremendous impact on the metal finisher. For example, poor casings can result in porosity in the plating, leading to CASS failures, poor machining may cause adhesion and cosmetic failures. Many problems that are evident after plating may have a root cause, which is outside of the plater's control.

The actual plating process for OEM wheels is divided into two fundamental operations, pretreatment and plating. Pretreatment is normally defined as all of the process steps up to the copper buff, while plating is defined as all the processes performed after the buff. So, while a nickel strike over zincated aluminum and acid copper plating are actually plating processes, they are part of the pretreatment line. Conversely, cleaning and activating the buffed copper wheels are technically pretreatment operations, but in wheel plating nomenclature they are incorporated into the plating line.

The pretreatment processing chemistry and sequence utilized must be capable of processing the specific aluminum alloy used. Typically, the aluminum used for cast OEM wheels is A356.

356 aluminum comes in many varieties, with the specific type represented by the alloy designation. For example, some alloy names include a letter before the alloy number. This letter is used to identify alloys that are slightly different in alloying composition or impurity levels. Examples include A356 or A380, which are just a bit different from 356 or 380. In addition, there may be a decimal notation following the alloy. Thus, an aluminum alloy XXX may be designated as XXX.0, XXX.1 or XXX.2. The decimal indicates the following:

- XXX.0 - Indicates the composition limits applied to an alloy casting.
- XXX.1 - Indicates the composition limits for ingots used to make the alloy casting.
- XXX.2 - Indicates the composition limits for ingots used to make the alloy casting, but which are normally tighter limits than no designation (XXX) or a designation of 1.

In practical terms the XXX.1 designation generally denotes aluminum ingots from a secondary source, such as ingots recycled from scrap aluminum, while the XXX.2 ingots are primary aluminum produced from reduction cells.

Pretreatment is often considered the most important step in any finishing operation, and while it is a complex science, there are several basic objectives for pretreatment operations in OEM wheel plating:

- Create a clean, active, uniform surface on the aluminum substrate.
- Remove foreign material from the surface of the aluminum substrate.
- Modify the aluminum substrate surface to create a specific surface topography that generates mechanical bonding sites.
- Prevent the highly active aluminum from forming a passive oxide layer prior to plating operations.

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Proper pretreatment is critical to ensure maximum adhesion, to optimize the appearance, and to control the performance characteristics. One critical aspect of any industrial finishing process is its ability to maximize productivity regardless of the condition of the base substrate. KCW partner and supplier, MacDermid, has a unique process cycle that maximizes the adhesion to the base aluminum, while simultaneously offering a high degree of resistance to substrate porosity, two of the major causes of rejects in OEM wheel plating.

There are several successful methods for processing A356 alloy, but the pretreatment process KCW uses is unique. It is called the "Dual Etch" cycle. There are several advantages to this cycle:

- There is a significant increase in adhesion compared to conventional aluminum pretreatment processes.
- It does not utilize nitric acid.
- The cycle is fluoride free.
- The process is cyanide free.

In general, the purpose for plating a wheel is to create a hard, corrosion resistant cosmetic coating that provides an attractive finish, provides an abrasion resistant coating, and protects the wheel from corrosion damage.

Plated wheels are commonly referred to as "chromed wheels". This term misrepresents what is actually an exceptionally complex plating system, where a series of coatings, each applied for a different purpose, are applied to meet the necessary quality requirements.

Typically, plated OE wheels have six or seven layers of plating. The basic plated layers are below:

1. Nickel strike
2. Acid copper
3. Semi-bright nickel
4. High sulfur nickel
5. Bright nickel
6. Microporous nickel
7. Chrome

Each layer serves a specific purpose, and to maximize the overall appearance and performance of the wheel all layers need to be applied correctly.

The strike layer is to provide adhesion of subsequent plating processes. Acid copper will level out minor surface imperfections in the aluminum casting, provide a soft deposit which can be polished, and increase the corrosion performance of the wheel by providing a copper barrier coating on the wheel. The nickel layers will be described in detail below. The chrome is applied for appearance, to prevent oxidation of the nickel and provide abrasion resistance.

The nickel layers have different properties. Specifically, each layer has a different electrochemical potential. These differences in electrochemical potentials are the main factor in the corrosion resistance of the wheels. The potential differences between the layers can be measured and specified. The most common method is the STEP test, a test which measures both the thickness of the nickel layers and the electrochemical potential of each layer. STEP stands for Simultaneous Thickness and Electrochemical Potential.

The multiple layers of nickel are the primary reason for the tremendous corrosion resistance seen on today's high-quality wheels. These anti-corrosion mechanisms are:

Barrier Layer (Bright Nickel)
Plating a single layer of nickel, such as bright nickel, over an aluminum or steel item will provide corrosion resistance to the part only so long as the barrier is intact.

Duplex Nickel (Bright Nickel over Semi-Bright Nickel)
By plating two layers of nickel, with the top layer being more active (i.e. less noble) a new level of corrosion performance is reached. This is generally accomplished by plating bright nickel over semi-bright nickel. Once the initial bright nickel barrier is penetrated, the corrosion spreads laterally into the more active bright nickel layer instead of penetrating the less active semi-bright nickel layer.

Microporous Nickel
The addition of a microporous nickel layer over a duplex nickel deposit further increases the corrosion resistance of a plated wheel. Instead of penetrating a single corrosion site corrosion potential is distributed into many smaller sites. The result is that instead of a single large corrosion site, there are hundreds or thousands of smaller sites, all of which corrode much more slowly.

High Sulfur Nickel
The addition of a high activity nickel layer between the bright and the semi-bright nickels result in even better corrosion protection. Once the nickel barrier is penetrated, corrosion occurs laterally in the active high sulfur layer, thus slowing penetration of the corrosion to the substrate.

Today's real chrome is the true choice for the best appearance, the best performance and the best value for the discerning consumer.

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