Plating Aluminum Wheels

Dayton Alloy Wheel combines electroless nickel with a decorative finish for corrosion resistance and good looks . . .

By Beverly A. Graves
Editor

Winters in the Midwest and northeastern United States are tough on automobiles, particularly the wheels. Not only do the wheels suffer through ice and snow, but they contend with sand and salt. Because of this, major automobile manufacturers have sought ways to improve the corrosion resistance of wheels while maintaining their decorative qualities.

In 1990, General Motors approached Dayton Alloy Wheel, Dayton, Ohio, and asked it to help with this predicament. For two years Dayton Alloy Wheel worked with Enthone-OMI to develop a process that would provide corrosion resistance as well as decorative qualities.

They found that $^1/_4$ to $^1/_2$ mil of electroless nickel under a decorative finish provided the best protection over the entire aluminum wheel.

"You could apply decorative plating until it is quite thick and achieve the corrosion resistance. But the weight of the wheel is higher than it is with electroless nickel," stated Jim Schardt, vice president and company founder. "We believe that the electroless nickel forms a chemical bond with the aluminum, not just an interlocking of materials. Because of this, there are no gaps between the wheel and the aluminum, which could cause peeling."

There are several layers of plating on each wheel. Electroless nickel acts as the barrier coating. When wheels enter the shop they are lightly buffed to remove machining lines. After buffing, eight wheels are racked on each plating rack. Each wheel's position on the rack and the time of day it is plated is carefully recorded. If there are problems with a certain wheel, employees can check the exact time and part position.

Parts go through a typical aluminum cleaning cycle: alkaline soak, etch, acid desmut and a double zincate. All solutions are monitored 24 hrs a day in the facility's laboratory. The electroless nickel system has its own controls for maintaining the solution. The nickel baths have automatic brightener feeders and the other plating baths feature automatic replenishment.

Following cleaning is electroless nickel plating and a copper plate. Wheels are then removed from the rack and buffed. After buffing, wheels are reracked for decorative plating. "A key part of the entire wheel-plating process is the auxiliary anodes used in decorative plating," noted Mr. Schardt. The auxiliary anodes provide the proper nickel and chrome thickness in holes and recesses.

On the second plating line, wheels are plated in a semi-bright and bright nickel followed by microporous chromium.

Once the wheels are plated, rigorous testing begins. As wheels roll off the line they are weighed as part of a thickness check. Following that, Tom Geraghty, quality control manager, uses a Fischer Isoscope beta backscatter instrument to check for plating thickness.

Another thickness test is the Kocour test, developed by Kocour Co., Chicago, Illinois. This test measures thickness by electrochemically stripping off each plating layer individually. It is also used to measure the electrochemical differential between nickel layers, which is called the step. Each automobile manufacturer has a specification for this potential.

Before Dayton Alloy Wheel was granted a contract to plate wheels for GM and Ford, as well as other automobile manufacturers, it had to develop failure analysis tests. "Basically, you had to think of every possible thing that could go wrong with the plating and why. Then you have to test to make sure it won't happen," explained Mr. Schardt.

Once a company develops a program, the automobile manufacturer audits the program and either approves, changes, modifies or rejects it. The program outlines tests and checks for the plating line solutions as well as for the finished product. "It is the price of doing business with automobile manufacturers," concluded Mr. Schardt.

One test the wheels must pass is the copper accelerated salt spray test (CASS). This test was originally used on bumpers, but was adapted for testing the plating on finished wheels. Wheels must withstand 88 hrs in the salt-spray chamber with no corrosion failure, even in low-current-density areas, where electroplating is usually thinner.

A General Motors and Ford adhesion specification is the reverse saw cut test. For this test a wheel is sawed in half with a rough band saw and no evidence of chipping or peeling is allowed. One of every 40 wheels, or two-and-a-half pct of production, is used for the saw test. Dayton Alloy Wheel pays for the plating and the OEM pays for the wheels. "Good adhesion is a prime prerequisite for durability, so it is worth the expense," said Mr. Schardt.

Even with all the testing and specifications the company must meet, its most formidable task is waste treating the spent electroless nickel. The line has two electroless nickel plating tanks. Because of the high volume of plating, the EN tank reaches six to 10 turnovers in just two days. At this point the second one has to be ready to go while the other one is treated.

Fortunately, the automated double hoist line, manufactured by Jim's Plating, Cincinnati, Ohio, allows operators to simply flip a switch and begin plating in the fresh tank.

The tank to be treated is pumped out to a holding tank where nickel is plated onto steel wool contained in a metal basket. The empty tank is then pumped full of nitric acid to strip away any electroless nickel. The nitric acid is then pumped to a holding tank where it is neutralized. Nickel-containing liquid from the EN holding/treatment tank goes through ion exchange. The regenerate is precipitated, and the resulting sludge dewatered.

The decorative finish on the wheels is the one that helps sell the car. The electroless nickel finish underneath is the one that will ultimately make the owner happy. Dayton Alloy Wheel has successfully combined functional and decorative plating so that it is all in one quality package. **PF**

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Captions:

1.
WHEELS from the electroless nickel tank proceed to the copper plating tanks

2.
COPPER-PLATED wheels are unracked and buffed before decorative plating

3.
WHEELS are numbered to identify plating times and rack positions

4.
PLATING line on the left is for electroless nickel and copper plating. The line on the right is for decorative nickel-chromium plating.

5.
SAW TEST is performed as part of GM specification for adherence testing

6.
TYPICAL CROSS-SECTION of plating shows the layers of EN, copper, semi-bright nickel and bright nickel.