A Low-cost Method for Polishing Aluminum Wheels For Chrome Plating

Pat Curran, Curran Enterprises, Huntington Beach, CA

A new low-cost process for polishing aluminum wheels for chrome plating has been developed that is saving polishing and plating companies up to $25 per wheel. The process is a simplified drag polisher that pushes four wheels face-first through a circular tub of specially designed grinding media. The process can polish stripped, partially polished, and copper-plated aluminum wheels. Plating rejects attributed to surface porosity and copper cut-through are significantly reduced.

For more information, contact:
Patrick Curran
Curran Enterprises
426 20th St., Suite #1
Huntington Beach, CA 92648
714-329-7411
patcurran@socal.rr.com

A new process for preparing OEM aluminum wheels for chrome plating has been developed that is saving platers and polishers up to $24 per wheel. The process is a simplified drag polisher that pushes four wheels face first through a circular tub of specially designed grinding media (see Fig. 1, 2, 3, and 4). Polishing with media allows for a more controlled and consistent grind that does not cut into the porosity layer below the surface. The process of impacting media against the surface of the wheel causes surface micro-porosity to collapse, significantly reducing plating rejects from embedded compound and dirty wheel surfaces (see Fig. 5 and 6). All of the process benefits of drag polishing are achieved for 15% of the capital cost. The maintenance of the machine is minimal and multiple machines can be set up for the price of one standard automated machine.

As can been in Table 1, the new process has significant advantages over the standard processes in use today. This initial capital cost is very low for automated equipment, yet the hourly production rate is similar. The process can accomplish approximately 80% of the raw aluminum, > 90% of copper polishing, and > 90% of stripped wheel polishing and significantly reduces the reject rate for poorly polished wheels and blistering. These estimates are for standard wheel geometries cast via gravity or low pressure processes. The advantages add up to significant savings per wheel as detailed in the process comparison chart (see Table 1).

	Simplified Drag Polisher	Large Drag Polisher	Robotic/ Turntable Polishing	Manual Polishing
Production Rate (wh/hr)	12	16	12	2/oper/hr
Capital Cost	$150,000	$1,000,000	$800,000	
Cost/wheel/hour	$12,500	$62,500	$66,667	
% Polish	80%	80%	70%	100%
Maintenance Intensity	Low	High	High	Low
Management Intensity	Low	Med	Med	High
Safety/Environmental Issues	Low	Low	Low	Med
As-cast Polishing for Pre-Plate	$3.70	$4.20	$9.10	$15.00
OEM Copper Buff cost	$1.25	$1.50	$2.20	$4.50
Cost of Poor Polishing Quality	$ -	$ -	$2.40	$2.40
Total Polishing Cost per wheel	$4.95	$5.70	$13.70	$21.90
Cost to Polish Stripped Wheel	$1.30	$1.60	$4.30	$10.00
Cost of Poor Polishing Quality	$ -	$ -	$14.00	$14.00
Total Polish Cost of Stripped Wheel	$1.30	$1.60	$18.30	$24.00

Table 1. Comparison of Common Aluminum Wheel Polishing Methods Costs

The total average polishing costs per wheel can be reduced approximately 75% with this process. This savings is much greater than the savings per wheel achieved by the very expensive polishing systems. As seen in Table 1, both the aluminum and copper polishing costs are reduced significantly. The cost of poor quality, which includes rejects due to polishing mistakes and plating rejects due to embedded compound and generally dirty wheels is virtually eliminated. The aluminum wheels need minor touchup prior to copper plating, no work prior to nickel/chrome, and minor work prior to replating.

Wheels that have been stripped typically undergo almost the same polishing intensity as raw castings. Cutting into the aluminum at this stage causes more problem than with a new casting and generates a high level of rejects after polishing. Because of micro-porosity exposure, stripped wheels also have higher reject rates during plating. Typically, about 50% of wheels that are stripped end up get rejected either after re-polishing or re-plating. This is why most companies dread stripping wheels. But with this process, stripped wheels can be polished very quickly without removing aluminum. Any surface micro-porosity uncovered during chemical stripping is crushed and the reject rate after polishing and after plating is reduced to 10 – 20%.

The four head assembly (see Fig. 7 and 8) is driven by one motor and gearbox and has no racetrack assembly. Wheel rotation on the fixture is induced without the aid of a motor. This significantly reduces the initial capital costs and ongoing maintenance expense. Loading and unloading only four wheels per cycle reduces the average wait time per wheel, increasing throughput. As with the racetrack polisher, force grinding with media is not as geometry sensitive as the other automatic grinding processes. Most wheels can be run under the same operating conditions and the machine can handle up to 22” diameter. One operator can run multiple machines.

This low cost method will enable casters and platers to integrate polishing into their operation or to allow polishing shops to simplify operations. The unattractive part of the wheel process can now be performed for low cost, low labor content, and high quality. This will change the way in which the industry is structured, improve profitability, and facilitate future improvements.

Cost Background

In total, the indirect and direct costs of current polishing methods for gravity or low pressure casted OEM chrome plated aluminum wheels are at least $22 per wheel and are roughly 60% of the overall plated wheel unit cost. It costs at least $15 per wheel to be polished for copper plating by an outside polishing shop. Some amount of copper polishing/buffing is usually needed for OEM wheels and generally costs about $5 per wheel. Both costs can vary significantly depending on casting quality, plating quality, and appearance specifications.

The polishing cost is also a function of the method in which the casting was produced. Of the common methods (gravity, low pressure, squeeze cast, forged), the majority of wheels are produced by the gravity and low pressure processes. Wheels made by these processes have a tremendous amount of porosity throughout the casting and rough surface texture and present the most difficult polishing condition. Forged and squeeze cast wheels incur equal or lower polishing costs.

Significant yet overlooked is the cost of poor polishing quality. Most wheels that are plated in the US are polished by hand and arrive for plating very dirty. Polishing defects such as divots, scratches, as-cast surface, and uncovered porosity are difficult to detect. Typically around 6% of received wheels are unacceptable due to polishing related defects. 2% are caught by incoming inspection and 4% sneak through and are plated. Wheels that have polishing compound imbedded into surface porosity will blister after copper plating, nickel/chrome, or in the field. This cost of poor polishing quality contributes at least $2.50 to the cost of every good wheel produced and increases administrative costs and unusable inventory by hundreds of thousands of dollars.

The cost of poor polishing quality is magnified for stripped wheels. Because of the nature of the chemical stripping process, most wheels emerge with eroded and porosity infested surfaces. This encourages polishers to grind away more of the surface in order to improve the appearance, uncovering more porosity. Typically 25% of wheels inspected after stripping and polishing are rejected, and 25% are rejected for plating defects for a total net reject rate of 50%. This method of polishing saves the wheel by eliminating additional aluminum grinding and collapsing surface micro-porosity.

Other Polishing Methods

Drag Polishing

The two basic types of automatic polishing processes are automation of manual grinding/polishing operations and grinding with media. The standard circular drag polisher holds a wheel from behind and pushes the wheel face first through the media around a track. Individual motors behind each wheel induce rotational and the racetrack setup usually has greater than six fixtures. Depending on the media used, this process can accomplish approximately 80% of the necessary polishing. This process costs approximately $1,000,000 but has significant maintenance issues with the wheel rotating mechanism. Consequently, less than 100% of the available machine capacity is typically utilized. Loading and unloading greater than six wheels per cycle adds a couple minutes to the average cycle time of each wheel. This process reduces the total polishing cost by 75%.

Robotic/Turntable Grinding & Polishing Stations

The most common course of automation is to duplicate that which is done manually as is done with robotic/turntable polishing systems. But, each wheel style must be handled differently and requires significant setup. The wheel-to-wheel variability is difficult to accommodate and accentuates the exposure of micro-porosity. This type of process costs approximately $800,000 and still leaves 30% of the polishing left to be done by hand. The grinding of aluminum by the machine and the 30% remaining to be done by hand causes wheels polished by this process to be prone to the same rejection rates and issues as manual polishing. This process reduces the total polishing cost by 38%.

Manual/Semi-Automatic

The as-cast surface is removed in progressively less aggressive grits until a smooth surface remains on all exposed surfaces. As the wheels are handed from one operator to another, handling damage is incurred. A significant amount of the as-cast surface of the wheel is uncontrollably removed during polishing, exposing micro-porosity and increasing chances for misshaped surfaces. Wheels arrive at the plating factory very dirty and are difficult to inspect. Many wheels that should be rejected sneak through inspection. These wheels end up being rejected at a later step after incurring additional cost. If the wheel is to be stripped, there is a 50% chance that it will never become a good wheel due to handling damage, polishing defects, and uncovered micro-porosity. It is also the most expensive method to polish wheels.

Figure 1. Wheel # 1 being pushed face first through media.

Figure 2. Rear view of media flowing through wheel # 1.

Figure 3. Wheel # 2 being pushed face first through media.

Figure 4. Rear view of media flowing through wheel # 2.

Figure 6: After Processing

Figure 7. Overall Picture of Machine

Figure 8. Empty Loading Fixtures