Improving Leveling in Nickel Systems

Q. We run a duplex nickel system and plate parts for the automotive industry. We are currently experiencing issues trying to improve leveling, but we are failing CASS (copper accelerated salt spray) testing early.

A. There are several issues to work through here, but first let's recognize these are common frustrations when running duplex nickel systems. Due to the numerous components involved in nickel processes, many applicators are confused by the potential causes for common issues such as poor leveling, coverage, and a loss of corrosion protection and may not know where to begin.

One of the first things to look at is to ensure all essential components such as pH, temperature, agitation, nickel chloride, nickel sulfate, boric acid and carrier are within range for both your semi-bright and bright nickel solutions. It is also important to ensure you are performing routine maintenance such as carbon filtration to keep the organics in the bath from climbing. Once you have established the components and operating parameters are all within range, you can begin to evaluate the solution using a hull cell to examine the overall appearance.

First, when running semi-bright solutions, ensuring a proper balance is met between the carrier and brightener is key as you want to keep the semi-bright functionally in line without sacrificing appearance. This balance is important because excessive brightener in the semi-bright can lead to a change in the grain structure of the deposit which can reduce ductility, STEP (simultaneous nickel thickness and electrical potential), and ultimately reduce corrosion protection.

It is worth noting one of the most commonly made mistakes to combat poor leveling and appearance is to make excessive brightener additions in the bright nickel tank. While this will improve leveling and brightness, it will sacrifice ductility and chromium receptivity. That's why we recommend instead of focusing all the efforts on the bright nickel solution, the first area of focus should be to optimize the semi-bright solution. The goal of optimizing the semi-bright solution should be to provide adequate leveling, optimal STEP, and a uniform opalescent deposit free of any grainy appearance. Once this goal is achieved, there will be less pressure on the bright nickel to require so much leveling that other characteristics end up being sacrificed. The bright nickel should provide the necessary brightness and leveling with the aid of the semi-bright but still maintain a deposit that is ductile without any chromium acceptance issues.

The recommendations above to optimize solutions can all be done using a hull cell to evaluate the deposit of both the semi-bright and bright nickel solutions. Oftentimes, two common cathodes used for hull cell testing are steel or polished brass. A simple solution to evaluate leveling on a hull cell is to scratch the bottom portion of the hull cell panel with 400 grit sandpaper applying moderate pressure. This creates a recess in the base metal which will then allow you to evaluate how well the nickel levels over the scratched area.

Related to this, one of the best tools a reputable supplier will use is a profilometer. This instrument measures the depth at which a surface is scratched to determine leveling. This can be done by using pre-scratched panels and measuring the surface before and after plating to determine the depth difference. After this is done, additions of components recommended by your trusted chemical supplier can be completed to show if an improvement was made. As a measurement tool, the profilometer is important because it quantifies the amount of leveling. Normally, when hull cells are performed, the results are somewhat subjective in nature. This analytical tool and process removes the subjectivity from the equation and provides quantifiable data to make sound decisions and allows for the addition of the proper components before parts fall below acceptable quality-control limits.

To recap, once you ensure all components and operating parameters are optimized, focus first on the semi-bright to ensure the proper balance is met between the carrier and brightener so your semi-bright can provide adequate leveling, optimal STEP, and a uniform opalescent deposit free of any grainy appearance. This will reduce the pressure on your bright nickel and allow it to provide the necessary brightness and leveling with the aid of the semi-bright without sacrificing ductility or causing any chromium acceptance issues.

It should go without saying that the quality of chemistry matters so be aware there are some systems on the market that may achieve a good STEP value, but sacrifice on overall appearance, leveling and grain structure. It is always best and more cost-effective in the long run to use a system for semi-bright and bright nickel that uses the highest quality materials which synergize well together.

These steps should help you troubleshoot and get to the bottom of your issues with leveling and failing CASS early to help you reduce lost time and expense. If you are still experiencing issues, a knowledgeable chemistry supplier should be able to perform advanced chemical analysis to better understand the important balance of components in your semi-bright and bright nickel solutions and provide you with specific recommendations to optimize performance.

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