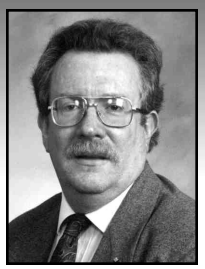

Hands-on Management

Fred Mueller, CEF • Wendt Dunnington Co.
Linfield Corporate Center • 546 Enterprise Drive • Royersford, PA 19468

Carbon Treatment & Filtration

Carbon treatment and filtration are two of the prime players in any effort to prolong the useful life of electroplating baths. The need for and response to carbon treatment varies from bath to bath. Bright Watts nickel solutions are a real dichotomy, because most addition agents for bright nickel are not removed efficiently by the activated carbon used in carbon treatment. This means we can run a little bit of activated carbon (one to two lb per 1,000 gal—see Tip #1) on the bath at all times. Organics that are not part of the brightener system (such as oils and greases—see Tip #2), as well as brightener decomposition products, can be kept at a minimum in this way. A carbon pack that is adequately sized for your operation and well maintained will keep the plated deposit near the peak of its physical properties and decrease the need for frequent batch (out-of-tank) treatments. At the same time, however, bright nickel chemistry can be controlled extremely well with a periodic carbon treatment.

If, after running tests, it proves necessary to batch treat, use the least invasive treatment first. Try a simple carbon treatment on a small amount of the plating bath and, if successful, it may be the only treatment needed to return the bath to service. High pH and oxidation (peroxide or permanganate) treatments are the "big guns" and should only be used if absolutely necessary.

Carbon Treatment for Watts Nickel

The following steps should be

followed to carbon treat a Watts nickel solution:

1. Carefully transfer the plating solution to a suitable treatment tank (clean, made from compatible material that can safely operate at 175 °F with heat and agitation).
2. A pH change may not be necessary to treat your bath, but if you need more efficiency, the pH of the bath can be adjusted to between 3.0 and 3.5.
3. Regulate the temperature of the bath to between 140 and 175 °F.
4. Add the activated carbon (about 4–8 lb, based on the extent of contamination, per 100 gal of bath) and agitate the solution for a minimum of two hr at temperature (see Tip #3).
5. Allow the solution to settle without agitation for one hr or longer. At many plating shops, this is an overnight operation. It is a great time to clean up the plating tank. Check the condition of the tank, anodes and filter.
6. Using filter media fine enough to filter out the carbon (usually a pre-coating filter), filter the solution back into the prepared plating tank. For a small bath, filter into a clean, second tank before going back to the plating tank to keep the carbon carry-over to a minimum. Hint: Start with the inlet hose near the top of the treatment tank to filter faster and cleaner by avoiding sucking up the activated carbon sludge off the bottom of the treatment tank.
7. After the bath is pumped back, clean the filter and properly dispose of the carbon and leftover solution.
8. Measure and adjust the plating bath chemistry. Start with pH and temperature, then test for nickel (metal), chloride, boric acid and addition agents. Make any necessary additions.
9. Plate.

High pH with Carbon Treatment Steps for Watts-type Nickel

The purpose of a high-pH treatment is to control/remove some metals not readily dummy-plated out of the solution (iron +3, trivalent chromium, aluminum and silicon—generally present as a silicate—from cleaners). Note: This treatment can be done without the carbon if only a high pH treatment is needed.

An oxidizer, such as hydrogen peroxide, must be added to the high pH treatment to change the valance of the iron from +2 (ferrous) to +3 (ferric) so that it can be removed as iron hydroxide.

The solution pH is increased by the use of nickel carbonate. Be sure to read the MSDS and use the proper protective equipment. Nickel carbonate is very messy to add dry, so it is recommended that a slurry be made using about eight lb of nickel carbonate with one gal of DI water, and a dash ($^1/_4$–$^1/_2$ fluid oz) of the brightener package's wetter/anti-pitter. The carbonate reacts with the acid in the solution and raises the pH. If the boric acid that buffers the solution is present in high concentrations, the target pH of 5 can be very difficult to reach. So, if you have the time, let the bath cool to room temperature and

drop out some of the boric acid before pumping just the solution over to the treatment tank.* This will help limit the amount of nickel carbonate used and help keep the nickel metal concentration from going too high.

High pH Steps

1. Carefully transfer the plating solution to a suitable treatment tank (clean, made from compatible material that can safely operate at 175 °F with heat and agitation).
2. Regulate the temperature of the bath to between 140 and 175 °F.
3. Add the nickel carbonate slurry with good mixing, and try to reach a pH of about 5 or a little over. Agitate for one hr and check the pH again, adding slurry if needed. The nickel carbonate reacts slowly, so let some time pass between pH measurements.
4. Add the activated carbon (about 4–8 lb, based on the extent of contamination, per 100 gal of bath) and agitate the solution for a minimum of two hr at temperature. For very contaminated baths, two treatments with a little less carbon are better than one with too much carbon.
5. Allow the solution to settle overnight without agitation. This is a great time to clean up the plating tank. Check the condition of the tank, anodes and filter.
6. Using filter media fine enough to filter out the carbon (usually a precoating filter), filter the solution back into the prepared plating tank. For a small bath, filter into a clean, second tank before going back to the plating tank to keep the carbon carry-over to a minimum. Hint: Start with the inlet hose near the top of the treatment tank to filter faster and cleaner by avoiding sucking up the hydroxides and/or activated carbon sludge off the bottom of the treatment tank.
7. After the bath is pumped back, clean the filter and properly dispose of the carbon and leftover solution.
8. Measure and adjust the plating bath chemistry. Start with pH and temperature. Dilute sulfuric (one part acid to three parts water) is used to lower the pH. Then test for nickel (metal), chloride, boric acid and addition agents. Make any necessary additions.
9. Plate.

Carbon Treatment with Oxider Steps for Watts-type Nickel

For these solutions, hydrogen peroxide is added to the carbon treatment almost routinely (be sure to read the MSDS and be extremely careful). It should **not** be automatic. Although adding an oxidizer can alter organic materials structurally and make them easier for carbon to adsorb, it can also create "problem organics" that can be difficult to remove and are harmful to the deposit.

After carbon treatment, if testing indicates oxidation treatment is needed, then go to the next step. It is best to carbon-treat first to remove as many organics as possible before proceeding to a peroxide or permanganate treatment. Permanganate is a very powerful oxidizer—stronger than hydrogen peroxide—and if used, it must be followed by the high-pH treatment to remove the manganese dioxide that is formed.

Add a pint to a quart of 35-percent hydrogen peroxide per 100 gal of solution before adding the carbon, and give it time to react with the organics. A minimum of two hr is required. Any unreacted peroxide will come out as a gas when the carbon is added, so using a respirator is a wise idea.

Good luck! P&SF

References

Carbon Treatment & Filtration, AESF Training Course

"Nickel Plating," Dr. Gary W. Loar, McGean, Inc., Cleveland, OH, *PFOnline* article.

"Carbon Treatment," *Plating Process Systems* (www.platingprocess.com).

**Thanks to Todd Grundy, chemist at Wendt Dunnington Co., Royersford, PA. for this handy bit of information.*

Bath Maintenance Tips

1. The ideal way to use activated carbon as part of your everyday filtering system varies with the type of filter being used. In general, you first need to make the filter media capable of filtering the carbon fines by adding a little diatomaceous earth/filter aid. This is accomplished by recirculating (closed loop) the solution in a side tank, then slowly adding the filter aid. (Always be sure to read the MSDS and use proper protective equipment.) Use enough to completely cover the filter media, but no so much that you'll slow down the flow through the filter and shorten the effective life of the packing. Before moving to the next step, be sure that the solution clears up, which means that the filter is working properly. Next, add about 25 percent of the carbon that you plan to use during the time you will run the filter pack (one week to a month). Add the rest of the activated carbon through the side tank in small amounts over the life of the filter pack. This keeps fresh carbon on the surface of the filter media and helps prevent channeling of the solution through areas on the filter with the greatest flow. Note: It is more important to keep the flow going at all times with vertical plates than horizontal plates, because the filter pack can fall off the media if the flow slows too much.
2. Just a few sources of foreign organics: sizing in anode bags and wound filter tubes, algae growing in the DI water system, filter aid, oxidation/chlorination of any of the organic additives in solution as a result of high voltage at the anode (lack of anode area). Not all of these organics are easily removed with activated carbon. Run plating tests (Hull cell) on the materials that come into contact with the bath for soluble organics to be sure they have no harmful effects.
3. Not all activated carbon is created equal. Ask your supplier for a recommendation. Some activated carbon is acid-washed, using either hydrochloric or sulfuric acids. When using this type, be sure to pick the right anion for the plating bath. For example, don't use a hydrochloric acid-washed carbon to treat a bright acid-copper bath, because the chloride ion may end up outside the 50–100 ppm range.