SERFILCO

CARBON TREATMENT METHODS FOR PLATING SOLUTIONS

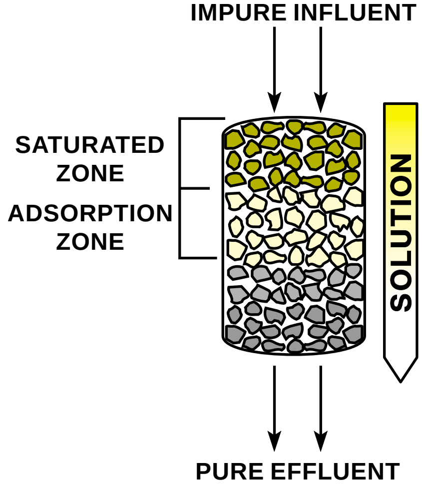
Make uniform brightness and ductility possible

Every plater knows the importance of brighteners/additives to the plating process. In fact, without these additives, electroplating would be a very different process today. Brighteners/additives lower surface tension, create more uniform and better organized grain structure, improve deposit leveling, improve deposit distribution, and in some cases, improve ductility, mechanical stress, throwing power or hardness.

The majority of these additives are organic in nature, but some may have an inorganic component as well. Almost all additives will slowly break down in the electrolyte, causing organic contamination that will be detrimental to the process if not controlled within allowable limits. Often, brightener breakdown products will be the number one source of organic contamination. However, other organics from drag-in or leaching mask/resist materials may also add to the total contamination load in the bath.

The original method of removing organic contaminants, "batch carbon treatment", involves transferring the solution to a separate treatment tank for the messy job of carbon treating. The solution is then heated and mixed as powdered carbon, and often filter aid is added, then allowed to settle. Typically, this method causes the loss of up to 20% of the solution because the saturated residual material at the bottom of the treatment tank is unfilterable after settling. It, therefore, remains for disposal while the balance of the solution is decanted and filtered back to the plating tank. Also, strong oxidizers such as hydrogen peroxide or potassium permanganate are often added because they help remove the heavy load of organics. Since this process involves shutting down production, batch carbon treatment is performed as infrequently as possible, and usually when the rejects begin to increase to a troublesome level. Keep in mind that with this method of removing contaminants, the quality of plated products progressively degrades over time as the contaminants build up in the bath. After batch carbon treatment, all organics, brighteners and breakdown products alike, are totally removed from the solution. Therefore, the full amount of brightener must be added back to the plating tank. Overall, this method of carbon treatment is the most costly and is not used by progressive operations unless absolutely necessary. It becomes "necessary" only if the bath is so overloaded with organic contaminants that complete and immediate stripping is required.

CARBON ADSORPTION COLUMN



Continuous carbon treatment has been used for many years as a method to control organic contamination. Basically, filter aid (diatomaceous earth) is coated on the filter media through a slurry tank to form a thin uniform "cake". Horizontal disc filtration systems are most often used for this method, however, vertical systems using cartridges or sleeves can be used as well. Powdered carbon is then added to the cake by dispensing through the slurry tank. Since this method exposes all of the solution continuously, at the turnover rate of the filter system, the removal of brightener and organic contaminants occurs at a fairly high rate. In the normal mode of operation, the amount of usable organics in the bath

Typical filter chamber/ carbon chamber arrangement

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is much greater than breakdown products, however, the attrition rate of "good" organics (brighteners) is high enough to have a fairly significant cost impact. An analogy that is sometimes used regarding this method is *chemotherapy*. There is a loss of some "good" cells in the pursuit of removing all the "bad" cells. This method is messy and labor intensive when changing media. It is also important to note that you must remove and replace the carbon frequently because carbon will start to release the adsorbed organics back to the solution once it is saturated.

Another method of carbon treatment employs a system that is typically used on a periodic basis. This system is similar to a filtration system in that it has a pump and chamber. Often, it is portable, so that it can be wheeled into service as needed. The chamber is filled with granular carbon in bulk form, in a bag, or in a canister. The canister is the most effective way of using granular carbon. The best systems have particle pre-filters to prevent "dirt" loading of the granular carbon. A filter micron density of 1 to 10 is most commonly used. These systems are also available with post-filters to capture stray carbon particles before they enter the plating tank. Some canisters are designed with a built-in filter to prevent this possibility. A .3 to 3 micron filter density is used for this purpose. While this treatment can be used to strip the bath of all organics, as a batch treatment does, it usually takes place concurrent to production and is used to **control** the level of organic breakdown products in the bath. This method is easier, less costly, and much cleaner than batch carbon treatment.

The current trend in the metal finishing industry favors a more precise approach to controlling organic contaminants. Filtration systems are designed with both a filtration chamber and a carbon "polish" chamber. The filter chamber can be for cartridge or disc media and is sized for the turnover rate necessary to maintain a particle free solution. Various types of carbon cartridges, bulk granular carbon, granular carbon in bags or replaceable granular carbon in canisters can be used in the carbon chamber. Again, replaceable granular carbon in a canister is the most efficient option. The system is "piped and valved" to desired operating mode options. For example, a continuous side stream of approximately 10% of the solution going through carbon may be desired. Or perhaps, a 0 - 100% option of carbon availability is more appropriate for a particular application. Typically, the organic contaminants are monitored by qualitative or quantitative methods and controlled to keep the bath within prescribed operating parameters by intermittent carbon polishing or continuous variable flow control through the carbon chamber. An example from the printed circuit industry involves monitoring the deposit ductility (elongation) from the electrolytic copper plate bath and adjusting the frequency or solution flow through carbon accordingly. This method eliminates production downtime, maintains the most consistent product quality, consumes the least amount of brightener, and is the cleanest and least costly approach to removing organic contaminants from plating chemistries.