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HARD CHROME PLATING OF GRAVURE CYLINDERS

ABSTRACT

A discussion of methods of hard chromium plating gravure cylinders; a look at plating developments and an examination of the advantages new plating solutions offer for achieving more uniform plating results and better quality reproduction.

By Eric Svenson,
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General

The use of hard chromium for the electroplating of gravure cylinders is well known to those skilled in the art. Hard chromium deposits have been used by the gravure industry for approximately 3 to 4 decades. Since the time of the introduction of the first hard chromium plating baths, several developments have been made in this area.

There are presently five basic bath types on the market today that can be used for plating of cylinders in the gravure industry. Many gravure platers have experimented with proprietary baths such as the fluoride type. A good majority of these have returned to the use of the original standard bath.

The rejection of these proprietary baths is due in many cases to the supplier's lack of knowledge as to the needs and requirements of the gravure plater. Several of the newer baths have a definite place in the trade when properly applied or tailored to the plater's needs.

It is unfortunate that with such a vast amount of knowledge available in this area that so little has been done for an industry as large as printing and gravure.

The purpose of this paper is to familiarize the gravure platers and industry with the various baths available along with their proper application and use.

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Figure 1. Jack O'Connor (L), exec. VP of Art Gravure Corp., Cleveland, with author Eric Svenson, watch a chrome plated cylinder in operation on Art Gravure's newer high speed Motter press

HARD CHROMIUM PLATING OF GRAVURE CYLINDERS

By Eric Svenson

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A discussion of methods of hard chromium plating gravure cylinders; a look at plating developments and an examination of the advantages new plating solutions offer for achieving more uniform plating results and better quality reproduction.

Part 1

For nearly forty years leading gravure printers have acknowledged the use of hard chromium for electroplating gravure cylinders as the accepted method for increasing cylinder life and press runs. And, since hard chromium plating baths were first introduced commercially in 1930, many developments have been made to help improve and upgrade plating performance.

As a result, today, the gravure industry has available for its use five basic types of plating baths for plating cylinders with hard chromium deposits. Unfortunately, many gravure platers have experimented with the several proprietary baths available, such as the fluoride bath, and then have gone back to using the original standard bath. At Platers Supply we're convinced that the rejection of these proprietary baths is due, in large part, to a lack of knowledge on the suppliers' part as to just what the gravure plater's requirements are. We believe that most of the newer baths have a definite place in the trade and will find greater acceptance when they are applied properly or tailored to the platers' exact requirements.

It is unfortunate that, with the vast store of know-how available on this subject, so little has been done to assist an industry the size and scope of gravure plating. For this reason, the purpose of this article is to help familiarize gravure platers with the variety of bath types available and their proper application and use. It will not only discuss bath advantages and limitations but will describe how one leading gravure printer, Art Gravure Corp. of Cleveland, uses a proprietary bath to help achieve long press runs with uniform results from the first printed piece to the last.

As a subsidiary of the Cleveland Plain Dealer, Art Gravure prints that paper's Sunday magazine as well as meeting its other gravure requirements. It also serves papers in New Orleans, Syracuse, Rochester, Buffalo, Newark, St. Louis, Fort Wayne, Akron, Youngstown, and Pittsburgh. Art Gravure Corp. also prints the TV logs for two newspapers.

According to vice president-general manager John F. O'Connor, press runs vary over a wide range but often run into the millions, so cylinder life is extremely important. He says that the plant normally produces ten to twelve million copies a week. So reproduction fidelity over long runs is an absolute must and Art Gravure is interested in any method that will help improve its capabilities for achieving long runs for each cylinder. The results Art Gravure achieves through use of a proprietary bath will be discussed in some detail in a later installment of this article.

Although the gravure industry uses terms such as rolls, rollers and cylinders to describe specific pieces of equipment, for the purpose of this article the single term cylinder is used throughout to describe both rolls and rollers since the finishing and plating process is similar in both cases.

Why Hard Chrome?

Let's take a look at some fundamentals. By nature, chromium is a hard metal with a fine grain structure. This makes it ideal for protecting the engraved copper deposits applied to gravure cylinders. During press runs of any length hard chromium protects the cylinder from wear caused by paper and grit abrasion and, under normal conditions, enables the cylinder to print in clearer, sharper lines for the entire run.

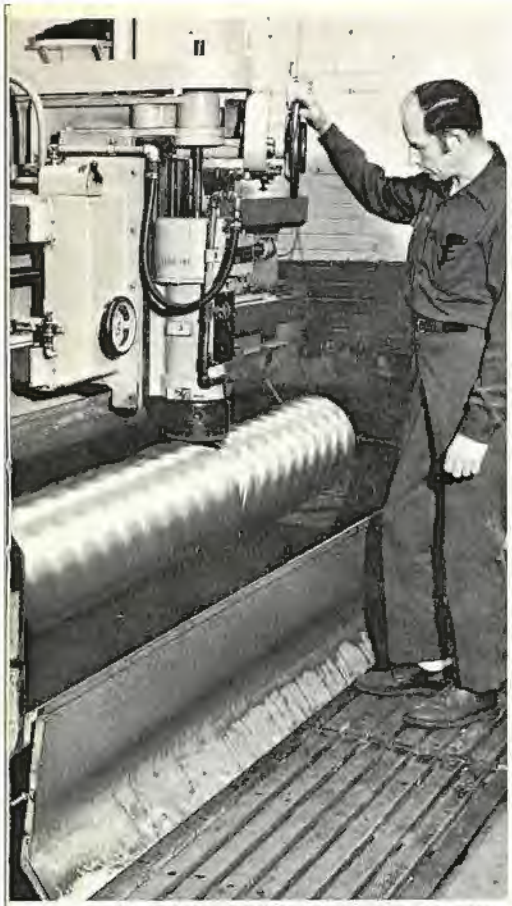

Figure 2. Larry Pfeil of Art Gravure operates the grinding machine to prepare the copper deposit to a smooth finish prior to engraving

Chromium plated cylinders also have greater corrosion resistance which protects the cylinder during storage and permits it to be put back into service quickly with a minimum of preparation.

Without the abrasion protection of hard chromium, cylinders wear quickly and the printing soon becomes distorted. Properly applied chromium deposits protect the engraving and extend its reproduction fidelity through several press runs.

This is possible because the normally poor micro throwing power of chromium plating baths enables them to reproduce the copper substrate surface exactly. Thus the engraving lines and patterns remain sharp and clear. This differs from plating solutions with good micro throwing power, such as bright nickel, which would tend to fill in the engraved lines. For this reason, special care must be taken to polish cylinders before hard chromium plating since the chromium bath will also reproduce any undesirable surface imperfections in the copper plating such as nicks and scratches.

Cylinder Preparation

The manufacture, polishing, engraving and plating of gravure cylinders is an exacting and involved process requiring a great deal of experience and skill. Normally, each plater develops his own procedure for preparing the cylinder for plating. For this reason, it is not within the scope of this article to suggest a definitive method of cylinder preparation. But, we do believe it may be instructive to note a general procedure leading up to and through the plating process based on the experience at Art Gravure.

1. Apply separating solution to thoroughly cleaned copper shell.
2. Acid copper electroplate.
3. Grind copper deposit to smooth finish by mounting it in a lathe and rotating it at about 60 rpm. The grinding stone rotates at 90° to the cylinder in a lubricant solution.
4. Photoengrave copper deposit.
5. Run proof to locate any defects in the engraving.
6. Correct engraving – re-proof.
7. Hand polish cylinder.
8. Clean with solvent to remove ink from engraving.
9. Clean cylinder in hot alkaline cleaner. Both soak and electrocleaning methods are used. Cylinder is also preheated in this solution.
10. Rinse with water.
11. Acid pickle in hot dilute sulfuric acid.
12. Rinse with water and examine for cleanliness by looking for water breaks.
13. Hard chromium electroplate to desired thickness.
14. Rinse with water and wipe dry.
15. Final hand polish to remove minute nodules. If these nodules are left on the surface, inks and dyes will be transferred onto the engraved surfaces creating a condition known as scumming. This also causes excess wear on the doctor blades.

Note: The degree of final polishing depends upon the condition of the chromium deposit and the type of material to be printed. In general, the smoother the material, the higher the degree of final polishing that is required.

Past Difficulties in Gravure Plating

Even though hard chromium deposits have been used in gravure cylinder applications for many years it would be misleading to assume that there have been no problems. For example, in the past, platers have encountered the following common problems caused by hard chromium deposits:

1. Lack of hardness resulting in excessive wear.
2. Poor line delineation causing poor quality reproduction.
3. Porous deposits that don't wipe properly.
4. Tendency of deposit to nodulate causing printing to smear.

All of these problems are due primarily to bath chemistry and method of plating. But, newer developments in the plating industry make it possible to substantially upgrade hard chromium deposits and eliminate these difficulties. We will deal with these problems and possible solutions through use of these new developments and plating baths.

Two Basic Plating Methods

There are two basic methods of cylinder plating in the gravure industry today—horizontal and vertical. Of the two, horizontal suspension is the more common. And, because rack and contact design and method of suspension in the plating bath differs with each method, we will deal with them separately.

Horizontal suspension. In plating horizontally, for example, the cylinder is suspended either fully or partially submerged in the bath. It is supported at each end by its journals which also serve as electrical connections. In some cases special copper and steel devices are bolted to each journal to insure proper contact and it is important that the connections are tight so the electrical circuit remains unbroken, and to prevent arcing. The trend in newer plants is to use a special copper drum with contact brushes.

Before cylinders are immersed in the plating bath they should first be preheated. Cylinders to be fully submerged should be heated to the plating bath's operating temperature; partially submerged cylinders require heating to about 150° F.

To insure a uniform deposit, the

cylinder is rotated continuously by a special device as soon as it is placed in the bath. Rotation speed varies from 1/4 to 10 rpm with the exact speed being determined by the solution being used and other plating conditions.

In horizontal plating either saddle type or round tank anodes can be used. However, the saddle type is usually preferred since it maintains a more uniform current density on the cylinder being plated. To prevent chromium buildup near the cylinder ends it is important that anodes be spaced from 2 to 12 inches from each end. The exact spacing is determined by the tank setup, bath type and current density being used.

Vertical suspension. Although not as popular as the horizontal method, vertical plating is used in many plants because it uses less floor space. However, this advantage is offset somewhat by increased headroom requirements. This situation is frequently resolved by embedding the tanks in the floor.

In the vertical method a fixture is used to support the cylinder top and bottom. And while tight contact devices, similar to those in horizontal plating, are used in vertical plating to prevent arcing, the cylinder is normally held in a fixed position, fully submerged with no rotation.

Round anodes, designed to distribute current equally along the full length of the cylinder, are suspended on a contact ring and spaced at proper intervals around the cylinder. The anodes must not exceed the cylinder in length in order to prevent the possibility of excessive buildup on the cylinder ends.

Frequently, resistance of the tin-lead anodes used will cause most of the current to pass through the top part of the anode with little or no current at the bottom. When this happens the chromium deposit is distributed unevenly. This situation is corrected by connecting special contact wires to the bottom of the anode or by using anodes with a conductive core.

Another serious consideration in vertical plating is maintaining uniform heating throughout the plating tank. Without proper agitation the solution near the top becomes warmer than that at the bottom. This condition will cause unwanted variations in the structure of the chromium deposit. Many variations can be eliminated readily through use of air agitation in the tank to keep solution temperatures even throughout.

In vertical plating, too, the cylinder should be preheated to the plating bath's operating temperature before immersing it in the bath.

Part 2

Plating Conditions

Bath composition. Cylinder plating conditions are directly related to the bath being used. Some of the newer proprietary solutions operate at reduced chromic acid concentration which increases plating speed and reduces fuming of the bath during the plating operation. Future installments of this article will deal more specifically with various bath chemical compositions and their influence on plating conditions.

Temperature vs current density. In all baths used at present in gravure cylinder plating there is a direct relationship between solution temperature and current density. Proper exploitation of this relationship produces the best quality deposits. In fact, some of the newer baths make it quite possible to operate at increased current density without excessive buildup which permits increased plating plant production. Table I should be used as a guide in determining this relationship for most plating baths.

Solution agitation. Even though the need for agitation is more important in plating cylinders in the vertical position, development of some method of agitating all plating bath solutions is recommended as highly useful in maintaining ideal solution temperature throughout the bath. Air agitation is generally preferred and has found widespread acceptance in the plating industry. However, air agitation has one major disadvantage in that the solution will require increased and constant heating to insure uniform bath temperature.

Anodes. For years the preferred

TABLE I TEMPERATURE VS CURRENT DENSITY

Plating Method	Current Density	Amperes/Sq. Inch	
	1	2	3
Partially submerged cylinder	130°F.	135°F.	140°F.
Fully submerged cylinder	125°F.	130°F.	135°F.

TABLE II TYPICAL DEPOSIT THICKNESSES

Cylinder Type and Use	Chromium Thickness	Approximate Plating Time in Minutes for High Speed Baths
Shallow cut engraving for printing on paper & oil cloth	0.0002"-0.0004"	20
Deep cut engraving for printing on paper	0.0003"-0.0005"	28
Ordinary cloth printing	0.00015"-0.0003"	15
Heavy cloth printing	0.0003"-0.0006"	35

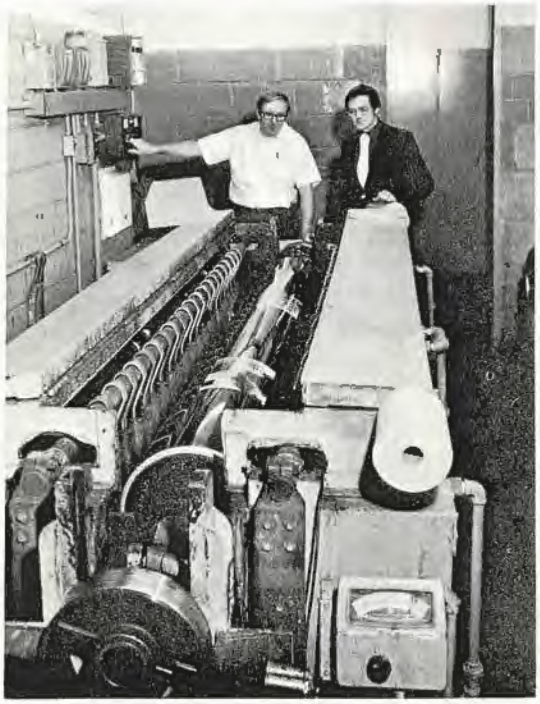

FIGURE 3
Joe Scherry (L), plating foreman of Art Gravure Corp., discusses with the author a plating operation in the Cleveland plant

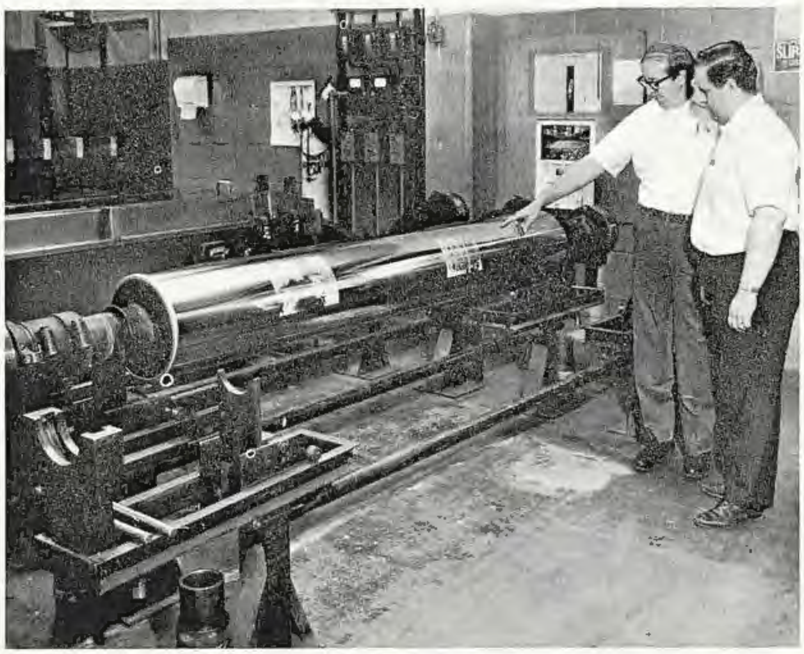

FIGURE 4
Below: Joe Scherry (L) of Art Gravure, and John Morris, research director of Platers Supply Co., examine a cylinder after plating

anode in the chrome plating industry has been one containing a 7% tin-lead alloy. But recent developments have made anodes available with newer alloys that have proven to be far superior to the conventional 7% tin-lead composition. The new alloys in anodes such as the Dura-Core usually contain a small amount of silver and are proprietary in nature.

The improved performance of these alloys stems from their ability to maintain the proper peroxide film. This film keeps the anode active longer and maintains a constant oxidation of trivalent chromium in the bath during the plating operation. In addition, the new alloys have less tendency to form the common hard shell scale that prevents passage of current into the bath and requires removal of the anode for cleaning to make it useable again.

The Dura-Core anode makes use of a conductive aluminum core for improved performance, which has proved its superiority over standard anode types. It can be made as either the round tank type anode or the special conforming saddle type. Its aluminum core has a great advantage over a copper core because aluminum anodizes and, thus, cannot contaminate the bath should the alloy wear through and expose it. Also the Dura-Core's hook, or contact point, and the core are one solid piece to provide good conductivity at all points on the anode. An aluminum core also gives the anode greater rigidity and this, combined with superior conductivity, permits cooler anode operation and prevents warping and anode curl.

It is important to establish a definite anode to cathode relationship for each cylinder being plated and this will depend primarily upon the bath and type of anode used. Normally, a ratio of 1-2:1 should be maintained between the anode surface and the cathode surface. This is calculated in square inches taking into account the surface area of the cylinder being plated and the active area of the anodes. Usually, a ratio of 1½:1 will provide optimum conditions.

Deposit thickness and plating time. Press run length and possibility of cylinder use for re-runs must be considered in determining the proper thickness of the hard chrome deposit because thickness is directly related to serviceable wear.

Consideration also must be given to bath speed and desired chrome thickness in calculating the required plating time. The bath manufacturer should be consulted for this information since plating speeds and possible current density varies with each of the several types of baths available. However, Table II can be used as a general guide to determine proper chromium thickness and approximate plating time required to achieve it with the newer higher speed plating bath types.

Use of Standard Bath

The first patents on standard hard chrome plating baths were taken out in 1890 by a number of French inventors. But, it wasn't until 1928 that a practical process was developed and by 1930 the bath was in use commercially. This first commercial bath consisted of chromic acid concentration of 30-60 ounces/gallon with a ratio of CRO^3:SO^4 of 100:1. The standard bath's operating temperature, then as now, was about 130°F.

The gravure industry began using the standard hard chrome plating bath shortly after its development and commercial availability. And, even though the standard bath is still suitable and still widely used in about the same proportions as in years past, it can hardly be regarded as the ultimate in light of the recent advances and developments in plating baths.

For one thing, standard baths contain a high chromic acid concentration, which makes them fairly expensive to make up and maintain. The same concentration also produces heavy fumes and solution sprays which may be hazardous to employees and corrosive to nearby machinery and equipment. The elimination of this type of health hazard has been the main thrust of recent OSHA and pollution control legislation.

Compared to the newer, high speed baths, the standard bath plating speeds are quite slow. This extends the required plating time and reduces production. This lack of speed is due primarily to the standard bath's high concentration and use of the sulfate ion as the only catalyst in the solution.

Then, too, hardness of deposit produced by the standard bath is inferior to those produced by certain proprietary solutions. This, naturally, limits the number of impressions a cylinder will make before requiring replating. There is also a relationship between hardness and crack patterns in the deposit which explains why cylinders plated in standard baths do not have the wiping characteristics of those plated with harder deposits. In general, the harder deposits have a pattern containing a greater number of cracks per inch.

Although deposits produced by a standard bath provide fairly good line delineation on the printed product, it is inferior to the fine delineation available with the newer proprietary solutions. Additionally, the standard bath has a greater tendency to produce nodules which further degrades the surface finish.

A distinct advantage of the standard bath is the fact that it will not etch into unplated areas, an especially important feature when plating hollow cylinders. This non-etching quality also permits the cylinder to be submerged in the plating solution without applying current. This is quite often a convenient way to bring the cylinder to bath temperature prior to the plating operation.

By contrast, when plating in proprietary baths of the fluoride type, the plating current must be applied soon after the cylinder enters the solution. On the other hand, certain non-fluoride proprietary baths offer the same advantage as the standard bath since they do not readily etch.

Another advantage of the standard bath is the fact that anode spacing is not as critical as it is with certain fluoride type solutions. For example, an anode spacing of 2" to 15" can be used under normal conditions. In addition, conforming saddle type anodes or round anodes placed in a ring around the cylinder are used quite frequently. It is also fairly common practice to plate cylinders of varying diameters in one tank without repositioning the anodes. When this is done each cylinder being plated is apt to have a different anode spacing.

Chemical maintenance of the standard bath is also easier than it is with certain proprietary solutions. The bath is maintained by analysis and the addition of chromic acid and sulfuric acid is all that is necessary.

Part 3

Fluoride Baths: Advantages and Disadvantages

Although development of the standard bath was a major plating advance, research continued as suppliers sought ways of producing even better plating results. For this reason, it was soon discovered that the addition of a fluoride ion to the chrome plating bath offered some unusual advantages.

As might be expected, the first fluoride type baths were essentially slight modifications of the original standard bath. Nevertheless, addition of the fluoride ion imparted markedly improved properties to the hard chrome deposit. Initially only small amounts of fluoride were used. But researchers soon found that, under certain conditions, the concentration could be increased with added benefits.

Fluoride baths are of three basic types: (1) self-regulated, (2) non-regulated, and (3) liquid catalyst. They are similar in one respect in that each uses a fluoride ion in conjunction with a sulfate ion to obtain the desired deposit and improve plating characteristics. Beyond that each type functions quite differently and we will discuss these differences in some detail later on.

Superior deposit: In general, fluoride baths produce a much superior deposit that can be obtained with a standard bath. For example, typical chrome deposit hardness produced by a fluoride bath ranges up to 72 on the Rockwell C Scale. Deposits from fluoride baths also have a greater number of cracks per inch which produces a smaller, finer crack pattern and gives cylinders plated in fluoride baths improved wiping characteristics. The result is increased cylinder wear resistance that pays off for the gravure printer in much longer press runs - either continuous or intermittent.

Higher plating speeds. By increasing the bath efficiency the fluoride ion allows for higher deposition rates at any given current density. And, because fluoride baths have less tendency to burn in high current density areas, plating can be accomplished at considerably higher current levels. This translates into substantial benefits in the form of higher plating speeds, reduced plating time and increased production. In fact, some fluoride type baths reduce plating time as much as 50%, which has the effect of doubling any gravure plant's hard chrome cylinder plating capacity.

The gravure cylinder plater also realizes other advantages from a fluoride type bath. For example, the cylinder surface is brighter and has less buildup at the edges and much less nodulation. This improved surface finish not only provides better wiping characteristics but reduces doctor blade wear and scumming.

Finer line delineation also insures that reproduction fidelity is much greater even on long runs. This permits doctor blades to be operated at an increased angle to remove viscous inks more efficiently and contribute to better quality printing.

Some disadvantages. Unfortunately, fluoride baths have some disadvantages which must be taken into consideration. The most important of these is its greater tendency to etch into any unplated areas of the cylinder than is found in the standard bath. This is an important consideration when plating hollow cylinders which cannot be plated in a fluoride bath without using proper stop off procedures to avoid undesirable etching. This is equally true of all other areas of the cylinder, such as the ends and shafts, that are not plated. They, too, must be stopped off with appropriate materials to protect them against etching. For this reason, a gravure plant weighing the possible use of a fluoride bath for plating will want to consider labor costs and time involved in making use of proper stop off procedures. These should be measured against the obvious advantages of the fluoride bath and a determination made as to whether this type of bath is economical or not.

Fluoride type baths also require maintenance of a fairly uniform anode/cathode area and spacing. Because the fluoride ion is consumed primarily through volatilization and chemical reaction with the lead anode interface, any increase in bath temperature or anode area or decrease in anode spacing will boost the fluoride catalyst's consumption rate. This is especially important to shops plating more than one size cylinder in the same tank. Under these conditions, the fluoride level will change constantly during the plating operation and eventually will produce defective results. This condition can be corrected, of course, through more frequent bath analysis and making adjustments to maintain the right proportions.

This makes it evident that in fluoride baths the catalyst is another variable to control which causes the plater to spend additional time on analysis and in making solution additions. Plants that use a dry blend compounded chrome product frequently require purchases of additional fluoride catalyst for this solution maintenance.

Another consideration is that in horizontal chrome plating operations fluoride baths require slower cylinder rotation - usually from 1/2 to 2 rpm. In some shops this may require the addition or modification of an appropriate rotating mechanism to accommodate a fluoride type bath. This is an important consideration because spotting of the deposit frequently results when cylinder rotation is too fast in a fluoride bath.

In addition, fluoride baths are more corrosive than the standard bath. This can result in faster corrosion and more frequent replacement of equipment such as tank liners, hoods, exhaust duct systems, anodes and heating coils.

Types of Fluoride Baths

As noted earlier in this article, there are three basic types of fluoride baths available. Suppliers of these systems usually have several baths in each category which differ mainly in the amount of fluoride used to produce desired chrome deposits. In most cases, each type is tailored to a specific application.

Self-regulated baths. These baths were developed soon after the basic fluoride bath was introduced. They use a partially soluble fluoride and/or sulfate compound to provide the required self-regulation characteristics. The theory behind the self-regulated bath is that the compounds will maintain a uniform concentration due to limited solution in the bath because they are added in amounts slightly in excess of requirements. In use, however, these catalysts tend to form a sludge and precipitate on the bottom of the tank. Often this requires extra heating and constant stirring of the solution to maintain the proper concentration to produce uniform plating quality.

A recent trend in the plating industry has been away from self-regulating type baths because of the cost and time required by the involved procedure used to insure proper solution maintenance.

Non-regulated baths. Although they have been available for some time, non-regulated fluoride baths have just recently started to find increased acceptance among platers as a good replacement for the self-regulated type fluoride bath. Usually, non-regulated baths are available as a dry blend of chromic acid and the desired fluoride compound. For the proper application and, under certain conditions, they have proven very satisfactory since, for the most part, the fluoride is consumed at a rate proportional to the consumption rate of the chromic acid.

However, serious plating difficulties can arise if these baths are used for the wrong plating application. As we noted earlier, a variation in bath temperature, anode area or spacing will create a corresponding variation in fluoride concentration. This happens quite often when different sized cylinders are plated in the same tank.

Since the fluoride and chromic acid are in a fixed proportion to each other in the non-regulated plating compound, it is impossible to change the concentration of one element without changing the other also. Under these circumstances solution maintenance becomes difficult at best. There is also the possibility that the dry blend may not be uniform in its mixture, adding a further complicating factor since even small additions may be too much or too little of one or the other component.

Frequently, an additional catalyst must be used in conjunction with the dry blend if the non-regulated bath is to be maintained properly. This may add significantly to the cost and labor of maintaining and operating the baths at maximum efficiency.

Liquid Catalyst Baths

The liquid catalyst bath is the most recent development in fluoride baths for the hard chrome plating field. In operation, it makes use of regular chromic acid in combination with the liquid catalytic agent to provide a unique combination of economy and easy operation.

FIGURE 5. Relative Etching Rates

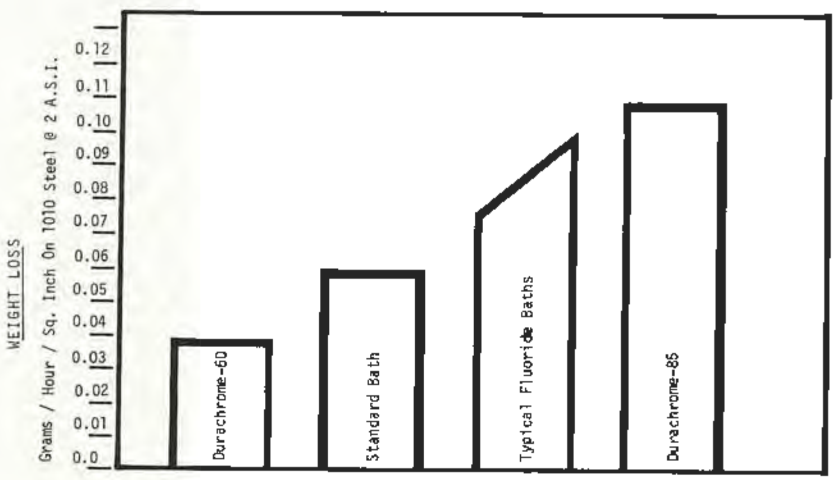

TABLE III BATH SELECTION

BATH TYPE	OUNCES PER GALLON OF CHROMIC ACID	CATALYST USED	RATE OF DEPOSITION	HARDNESS, WEARABILITY AND CRACK PATTERN	FINISH AS PLATED	LINE DELINEATION	WIPING CHARACTERISTICS	PLATING FUMES	POSSIBILITY OF ETCH	EASE OF BATH MAINTENANCE	SPECIFIC ROTATIONAL SPEED REQUIRED	NEED FOR CONSTANT ANODE SPACING
STANDARD BATH	33	NO	SLOW	POOR	DULL	POOR	POOR	HEAVY	LOW	GOOD	NO	NO
FLUORIDE BATH	33	YES	MED	GOOD	SHINY	FAIR	FAIR	HEAVY	MED	FAIR	YES	YES
HIGH SPEED FLUORIDE BATH	25	YES	HIGH	EXC	MIRROR	EXC	EXC	LOW	HIGH	FAIR	YES	YES
NON FLUORIDE HIGH SPEED BATH	20	YES	MED	GOOD	SHINY	GOOD	GOOD	VERY LOW	VERY LOW	GOOD	NO	NO

Most baths of this type are formulated in a manner that insures that all proprietary ingredients are present in the liquid catalyst. This simplifies solution maintenance since all it requires is adding the catalyst to the bath. Proper proportions are assured and, for most applications, regular schedules can be established for making additions. A typical example would be adding one gallon of liquid catalyst for every 100 pounds of chromic acid.

One such bath which has found ready acceptance because of its excellent results in gravure cylinder plating applications is the Durachrome 85 bath. It not only offers high speed plating - up to 60% faster than the standard bath - but it has the advantage of being used in a dilute solution that operates at 25 ounces/gallon. It is also in tune with ecological and health requirements because of its unusually good control of pollution and minimal solution spray.

Durachrome 85 bath produces bright, hard deposits with a very fine crack pattern that results in long press runs, increased doctor blade life and lack of scumming. When properly used, Durachrome 85 can be utilized by shops plating several different cylinder sizes with good results. This is due, in large part, to the ease with which this catalyst can be analyzed and maintained.

Aside from the fact that Durachrome 85 is a liquid, the main difference between it and other fluoride type baths is its use of another catalyst in conjunction with the fluoride and sulfate ions in the solution.

Liquid Catalyst at Art Gravure

One of the most successful applications of Durachrome 85 baths for gravure cylinder plating is at Art Gravure of Cleveland. Because most of their applications are for long runs on high speed presses, Art Gravure has used a fluoride type bath for years to achieve the required chrome deposit with optimum hardness and crack pattern.

More recently they converted to Durachrome 85 bath with even better results. It has enabled them to increase the speed of their plating operations while producing the hard chrome cylinder deposits required for good fidelity reproduction over extra long press runs.

According to Art Gravure plating experts, the new liquid catalyst bath, coupled with their painstaking cylinder preparation leading up to the plating, enables them to attain unprecedented economy and speed in overall plating operations. Every step of the cylinder preparation relies on modern equipment and up-to-date photoengraving practice and technology to insure the outstanding quality of their printed product.

Using Non-Fluoride Proprietary Baths

Perhaps the most important advance in the area of hard chrome plating is the development of the non-fluoride type bath for a wide range of precision applications. Although a recent development, it has already established itself in the plating field and has special significance for the gravure plating process.

One such bath is Durachrome 60 which uses a liquid catalyst with regular chromic acid and offers many advantages over standard and fluoride plating applications where cylinders of various sizes are processed in one tank. In addition, the catalytic agents in this bath are not influenced by variations in bath temperature or anode area and spacing.

Of special importance to the gravure plater is the fact that this particular non-fluoride bath has even less etching potential than the standard bath. In actual operation, Durachrome 60 has etched unmasked areas, such as cylinder ends and shaft, to a lesser degree than the standard bath used without a stop off or masking of unplated surfaces. Figure #5 shows the relative etch rate of various types of baths including Durachrome 60.

Durachrome 60 operates at 20 ounces per/gallon which provides reduced concentration that increases plating speed, reduces fuming and requires fewer pollution controls. It also produces harder chrome deposits - up to 68 on the Rockwell C Scale - than the standard bath, with a greatly increased crack pattern. The resulting deposit is slightly brighter, too, with fewer trees and nodules which reduces time and cost of post plating polishing.

The liquid catalyst in this formulation operates extremely well over a wide range of concentration. Even should slight variations occur in its concentration they won't substantially alter the deposits produced. This pays off by requiring less analytical control of the catalyst than required by fluoride type baths.

In addition, Durachrome 60 bath will operate at the same cylinder rotation as required by the standard bath. No modification or extra control of the rotational mechanism is needed. Fumes and solution spray from this non-fluoride bath are less corrosive, too, which should help increase plant equipment life.

Taken in combination, these features enable the gravure plater to produce a cylinder with deposits that provide finer line delineation, longer wear with less scumming and higher quality printing on both short and long runs.

Summary: Plating Bath Selection

Matching the plating bath to the application is important to gravure printing quality. That makes proper plating bath selection vitally important, too. Especially since the hard chrome deposits produced are the next to the last process prior to actual printing operations. Table III is a bath selection chart that shows the fundamental differences in the various types of baths available. A final selection should be made in consultation with your plating supplier.

As a rule of thumb, where one or two sizes of cylinders are plated in one tank, a high fluoride bath, such as Durachrome 85, should be used. This fluoride type bath is especially well suited for use where optimum hardness and crack pattern is required for long runs and where the proper stop off and masking techniques have been put into effect to prevent undesirable etching.

For plants that prefer to plate several sizes of cylinders in one tank a non-fluoride, high speed bath like Durachrome 60 should be considered. Under most plating conditions, the non-fluoride bath will not etch and anode spacing is not of a critical nature.

Both fluoride and non-fluoride type baths making use of a liquid catalyst offer economy with speed since solution analysis and maintenance are greatly simplified under most plating conditions. ☐