ELECTRONIC MATERIALS
PACKAGING AND FINISHING TECHNOLOGIES

SILVER GLO™ 3KBP

WITH SILVER GLO 33BP

For Electronic Finishing Applications

Regional Product Availability			
N. America	Japan/Korea	Asia	Europe
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DESCRIPTION

The Rohm and Haas Electronic Materials Silver Glo 3KBP process is designed to produce bright silver deposits over a wide range of current densities (0–70 amps/ft²), with high cathode efficiency and simplicity of process control. The 3KBP is suitable for all decorative applications and rack and barrel operations. Silver deposits from the 3KBP have superior tarnish resistance compared to other silver plating processes.

ADVANTAGES

- The 3KBP solution can be used in decorative applications, rack and barrel
- Ease of control
- Clear, water-white solution for easy viewing of work during plating

Silver Strike

As is customary in silver plating, a Silver Strike should be used prior to plating.

The formulation of the Strike solution should be:

	Metric	(U.S.)
Silver Metal as Silver Cyanide (80.5%):	1.8–3.0 g/l	0.22–0.37 tr. oz./gal.
Potassium Cyanide (KCN):	75.0–112.5 g/l	10–15 oz./gal.

The Strike should be operated at room temperature and 6 volts. For barrel operations, it may be necessary to modify the Strike to suit the specific condition. To insure maximum adhesion when plating copper or copper alloys, current should be on when entering tank. The Silver Strike formula can be modified to suit specific needs; see your Rohm and Haas Electronic Materials service engineer.

BATH MAKE-UP—Rack and Barrel Formulation

Chemicals Required	Metric	(U.S.)
Silver Metal as Silver: Cyanide (80.5%)	33 g/l	(4.4 tr. oz./gal.)
Potassium Carbonate: (K_2CO_3)	15–30 g/l	(2–4 oz./gal.)
Silver Glo 3KBP:	10–30 ml/l	(1–3% v/v)
Silver Glo TY or Silver Glo SX:	1–5 ml/l	(0.1–0.5% v/v)
Potassium Cyanide:	113 g/l	(15 oz./gal.)
3KBP Starter Salt:	10 g/l	(1.3 oz./gal.)

BATH OPERATION

	Metric	(U.S.)
Silver Metal as Silver: Cyanide (80.5%)	33 g/l	(4.4 tr. oz./gal.)
Potassium Cyanide:	113 g/l	(15.0 oz./gal.)
Temperature:	21–29°C	(70–85°F)
Agitation:		(18 ft./min.)
Current Density Range:	0–7 ASD	(0–70 amps/ft.²)

Modified Formulation

Where maximum brightness of the deposit is desired, it is recommended to substitute sodium carbonate for the potassium carbonate. In such a mixed sodium-potassium formula, the sodium ion in conjunction with the Silver Glo 3KBP has a synergistic brightening effect. For existing solutions that are being converted to the 3KBP process, this sodium ion may be introduced by substituting sodium cyanide for some of the potassium cyanide. The specific amount of sodium cyanide to be substituted will be recommended by our laboratory.

Where maximum luster or brightness is desired, Silver Glo 3KBP should be used upon make-up and Silver Glo 33BP should be used upon replenishment.

BATH MAINTENANCE

Silver Metal

Silver Metal should be maintained using silver cyanide according to the following procedure:

SILVER GLO 3KBP WITH SILVER GLO 33BP

SILVER CONTENT OF ROHM AND HAAS ELECTRONIC MATERIALS BRIGHT SILVER PLATING SOLUTION

I. Equipment

a) 250 Erlenmeyer flask

b) 50 ml burette

c) 10 ml Class A volumetric pipette

d) 100 ml graduated cylinder

II. Reagents Required

a) Silver plating solution

b) Concentrated sulfuric acid

c) Nitric acid

d) Distilled water

e) 2% Ferric ammonium sulfate indicator ($Fe_2(SO_4)_3(NH_4)_2SO_4 \bullet 24H_2O$)

III. Titrant

a) 0.1N Sodium thiocyanate (NaCNS)

IV. Procedure

a) Pipette a 10 ml sample of the silver plating solution into a 250 ml Erlenmeyer flask.

b) Under a hood (CAUTION: poisonous Cyanide fumes are evolved) add 20 ml of concentrated sulfuric acid and 5 cc of nitric acid. Heat to the evolution of white sulfur trioxide fumes. If charring persists, repeat the nitric acid addition and reheat to the evolution of sulfur trioxide fumes.

c) Cool, cautiously add 100 ml of distilled water and heat until the white precipitate completely dissolves.

d) Cool to room temperature, add 2 to 3 ml of 2% ferric ammonium sulfate ($Fe_2(SO_4)_3(NH_4)_2SO_4 \bullet 24H_2O$) indicator and titrate with 0.1N Sodium Thiocyanate (NaCNS) until a faint pink color appears. Read the burette for the total number of ml of 0.1N Sodium Thiocyanate (NaCNS) used and calculate.

V. Calculation

a) ml of 0.1N Sodium Thiocyanate (NaCNS) x 0.132 = tr.oz./gal. Silver Metal (Ag)

b) ml of 0.1N Sodium Thiocyanate (NaCNS) x 1.1= g/l Silver Metal (Ag)

c) ml of 0.1N Sodium Thiocyanate (NaCNS) x 0.16 = tr. oz./gal. Silver Cyanide (AgCN)

d) ml of 0.1N Sodium Thiocyanate (NaCNS) x 1.3 = g/l Silver Cyanide (AgCN)

Free Potassium Cyanide (KCN)

A suggested free KCN concentration is 90 g/l (12 oz./gal.). This should be checked periodically. Low free KCN, below 75 g/l (10 oz./gal.), will cause fogging and dullness in the low current density areas. Higher values, over 120 g/l (16 oz./gal.), may slightly reduce the high current density range. Where maximum brightness is desired, some of the potassium cyanide may be substituted by sodium cyanide. The sodium ion introduced by the addition of the sodium cyanide tends to impart additional brightness when used in conjunction with the Silver Glo Brighteners. Such a substitution should be made after consulting with your Rohm and Haas Electronic Materials service laboratory.

FREE CYANIDE IN ROHM AND HAAS ELECTRONIC MATERIALS SILVER PLATING PROCESS

I. Equipment

a) 5 ml Class A volumetric pipette

b) 250 ml Erlenmeyer flask

c) 50 ml burette

d) 100 ml graduated cylinder

II. Reagents Required

a) Silver plating solution

b) Water

c) 10% Potassium iodide (KI)

III. Titrant

a) 0.1N Silver nitrate ($AgNO_3$)

IV. Procedure

a) Pipette 5 ml of silver plating solution into a 250 ml Erlenmeyer flask.

b) Add 90 ml of water and 5 ml of 10% potassium iodide (KI).

c) Titrate with 0.1N silver nitrate ($AgNO_3$) solution, shaking the flask slowly until a faint milky turbidity appears. This turbidity should last for 1 minute.

V. Calculation

Read the total number of ml of 0.1N silver nitrate ($AgNO_3$) added by the burette and multiply this reading by:

a) 0.262 for oz./gal. free sodium cyanide (NaCN)

b) 1.97 for g/l free sodium cyanide (NaCN)

c) 0.348 for oz./gal. free potassium cyanide (KCN)

d) 2.61 for g/l free potassium cyanide (KCN)

SILVER GLO 3KBP WITH SILVER GLO 33BP

CARBONATES IN ROHM AND HAAS ELECTRONIC MATERIALS SILVER PLATING SOLUTION

I. Equipment

a) 10 ml Class A volumetric flask

b) 250 ml beaker

c) Whatman #30 filter paper

d) 50 ml burette

II. Reagents Required

a) Water

b) 10% Barium Nitrate solution

c) Distilled water

d) Methyl orange indicator (0.2%)

III. Titrant

a) 1.0N hydrocloric acid (HCl)

IV. Procedure

a) Pipette a 10 ml sample into a 250 ml beaker.

b) Add 100 ml water and warm.

c) Add with stirring 25 ml of 10% barium nitrate solution until no further precipitation forms. Allow precipitate to settle.

d) Filter through a Whatman #30 filter paper. Test the filtrate for complete precipitation by adding a few drops of barium nitrate ($BaNO_3$). Wash the precipitate with warm water.

e) Transfer the filter paper and precipitate to the beaker in which the above was performed.

f) Add 50 ml distilled water and 3 to 5 drops of Methyl Orange indicator (0.2%).

g) Titrate with 1.0N hydrochloric acid (HCl) to a pink color. Read burette and calculate.

IV. Calculation

a) ml of 1.0N hydrochloric acid (HCl) x 0.706 = oz./gal. sodium carbonate (Na_2CO_3)

b) ml of 1.0N hydrochloric acid (HCl) x 5.3 = g/l sodium carbonate (Na_2CO_3)

c) ml of 1.0N hydrochloric acid (HCl) x 0.92 = oz./gal. potassium carbonate (K_2CO_3)

d) ml of 1.0N hydrochloric acid (HCl) x 6.9 = g/l potassium carbonate (K_2CO_3)

Silver Glo Brightener

The Replenishing Brightener is Silver Glo 33BP for the 3KBP system. Silver Glo TY and Silver Glo SX act as an auxiliary Brightener and Wetting agent. Additions should be made when there is no work in the tank and preferably just before shutdown periods. It is better to make periodic small additions of both chemicals and brighteners rather than a few large additions.

Normal operations will require replenishing at the rate of 15–30 ml of Silver Glo 33BP per 25 ampere hours, and 1.5–2.0 ml of Silver Glo TY or Silver Glo SX per 25 ampere hours.

An overall lack of brightness at all current densities usually indicates the need for an addition of Silver Glo 33BP . Large additions of Silver Glo 33BP should be avoided since excess quantities of this brightener would cause dullness in the low current density areas.

Silver Glo TY is used in many of the applications, but where the heavy use of buffing compounds and polishing compounds occurs Silver Glo SX is the preferred wetting agent.

DEPOSITION RATE

Deposition Rate

Current Density A/ft²	10	20	30	40
Deposition Thickness microns	Time in Minutes			
2.5	150	72	52	36
5.0	300	144	104	72
7.5	450	216	156	108
10.0	600	288	208	144
12.5	750	360	260	180
15.0	900	432	312	216
17.5	1,050	504	364	252
20.0	1,200	576	416	288
22.5	1,350	648	468	324
25.0	1,500	720	520	360

SILVER GLO 3KBP WITH SILVER GLO 33BP

EQUIPMENT

Anodes: High-purity silver anodes (99.9%) should be used, or 316 Stainless Steel; anode bags should be made of 6 ounces cotton duck or dynel

Tanks: Koroseal-lined, polypropylene, or heavy-gauge polyethylene; under no circumstances should a fiberglass tank be used for any silver plating solution

PRODUCT DATA

Silver Glo 3KBP

Appearance:	Clear
pH:	8
Specific Gravity	1.2

Silver Glo 33BP

Appearance:	Clear
pH:	8
Specific Gravity:	1.2

Silver Glo TY

Appearance:	Clear
pH:	8
Specific Gravity:	1.05

Silver Glo SX

Appearance:	Clear, yellow-orange
pH:	6.5
Specific Gravity:	1.01

3KBP Starter Salt

Appearance:	White crystals
pH:	7.5

HANDLING PRECAUTIONS

Before using this product, consult the Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for details on product hazards, recommended handling precautions and product storage.

CAUTION! Keep combustible and/or flammable products and their vapors away from heat, sparks, flames and other sources of ignition including static discharge. Processing or operating at temperatures near or above product flashpoint may pose a fire hazard. Use appropriate grounding and bonding techniques to manage static discharge hazards.

CAUTION! Failure to maintain proper volume level when using immersion heaters can expose tank and solution to excessive heat resulting in a possible combustion hazard, particularly when plastic tanks are used.

STORAGE

Store products in tightly closed original containers at temperatures recommended on the product label.

DISPOSAL CONSIDERATIONS

Dispose in accordance with all local, state (provincial) and federal regulations. Empty containers may contain hazardous residues. This material and its container must be disposed in a safe and legal manner.

It is the user's responsibility to verify that treatment and disposal procedures comply with local, state (provincial) and federal regulations. Contact your Rohm and Haas Electronic Materials Technical Representative for more information.

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