Collection of formulas for chemical,electrochemical and heat colouring of metals,cyanide free immersion plating and electroplating

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CONTENTS:

1. CHEMICAL COLOURING OF COPPER/COPPER ALLOYS

2. CHEMICAL COLORING OF IRON

3. CHEMICAL COLORING OF STAINLESS STEEL

4. CHEMICAL COLORING OF SILVER

5. CHEMICAL COLORING OF ZINC

6. CHEMICAL COLORING OF ALUMINIUM

7. CHEMICAL COLOURING OF TIN,LEAD AND NICKEL

8. LUSTRE (INTERFERENCE) COLOURS

9. ELECTROLYTIC COLOURING

10. JAPANESE PATINAS

11. HEAT COLOURING

12. FEW FORGOTTEN PROCESSES

12. 13. DEGREASING

13. 14. PICKLING AND CHEMICAL POLISHING,MATT FINISHES

14. 15. IMMERSION PLATING

16. ELECTROPLATING

17. SHORT INSTRUCTIONS FOR SUCCESSFUL AND SAFE COLOURING AND PLATING OF METALS

18. LITERATURE

19. RECOMMENDED WEBPAGES

DISCLAIMER

GREEN FOR COPPER/COPPER ALLOYS ,Cu I

INGREDIENTS,grams on lit/ water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Copper sulphate						3				
Copper nitrate	300	250					100			
Copper acetate			100		56			20		
Ammonium carbonate				250	170					
Ammonium chloride			100	250			100	20		370
Ammonium sulphate						90				
Ammonia 25 %, in ml						1	400			750
Sodium chloride					56					
Potassium polysulphide	X?			X?					X?	X?
Potassium bitartrate					56					
Zinc chloride		250								
Acetic acid 5 %, in ml								1l		50
Nitric acid, in ml									50	

ADDITIONAL EXPLANATIONS: Cu 1

1.Some methylated spirit can be added.Before a treatment objects can be coloured black or brown.Between the applications we can use 36% hydrogen peroxide solution,every application can be applied only after previous layer is dry!

2.For bronze!

3.For bronze!

4.There are variants with smaller amount of ammonium chloride or carbonate.Before treatment objects can be coloured black or brown.Instead water you can use vinegar.If we take more carbonate,more bluish,if more chloride more yellowish colour.

5.Yellowish green.If we want more bluish green we must use ammonium carbonate solution,if more yellowish then sodium chloride.

6.For a large surfaces and an application by spraying.

7.Dark green, add only 200 gms water not 1 liter!

8.Yellowish green,no water!

9.Can be used on objects pretreated with black or brown colour,between applications 36% hydrogen peroxide solution can be used!

10. Bluish green,objects can be previously coloured black or brown!

GREEN FOR COPPER/COPPER ALLOYS/II,
Cu 2

INGREDIENTS,gms / lit. water	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Copper nitrate						80				X
Copper sulphate									70	
Copper acetate	120	10		80						
Copper chloride			200							X
Zinc chloride									9	
Ammonium carbonate							60			
Ammonium chloride	60	20		220	8	10	75	15	36	
Hydrogen peroxide 30 %										
Sodium chloride				80	8	45			36	
Potassium chloride			100							
Potassium polysulphide							50			
Acetic acid conc., ml.					50	60	120		18	
Acetic acid 5 %		1L						1 l		
Potassium bitartrate				80		10				
Potassium oxalate					4					
Iron acetate							50			
Glycerine									9	
Sodium oxalate								15		

ADDITIONAL EXPLANATIONS Cu 2

11. After application leave it to dry.

12. Yellowish green,no water!

13. For brass!

14. For brass!

15. Light green on a copper.Can be used on object previously coloured black or brown !

16. Bluish green on copper.Can be used on object previously coloured black or brown!

17. Greyish green on bronze,1000 cm3 water,120 cm3 acid!

18. For bronze!

19. For copper ,brush it on object!

20. Green on copper/copper alloys.three step process-first we use concentrated copper chloride/copper nitrate solution(15 minutes,90 C temp.),then rinse it well and treat it with sodium hydroxide solution(blue green,if we use only nitrate azure blue),rinse again,and treat with ironIIsulphate solution (or sodium oxalate or sulphite)colour must then be yellowish green.Finally we can coat it with diluted waterglass(3 %).According to US patent USPT 1,428,170!

BLACK AND WHITE FOR COPPER/COPPER ALLOYS, Cu3

INGREDIENTS,gms /lit. water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Copper nitrate	120									
Silver nitrate	0,5									
Potassium polysulphide		10	10							
Ammonium chloride		20								
Basic copper carbonate							200			
Ammonia 25 %							1 l			
Sodium hydroxide						50				
Potassium persulphate						10				
Iron-III-chloride				500						
Iron-II -sulphate					5					
Sodium thioantimonate			10							
Potassium permanganate					5			15		
Copper sulphate					50			120		
Potassium ferrocyanide				50						
Sodium thiosulphate										50
Iron nitrate										12
Bismuth nitrate									X	

ADDITIONAL EXPLANATIONS: Cu 3

1. Dissolve copper nitrate in 40 mll of water(hot),then add silver nitrate solution(hot water,10 mll).We can add some methylated spirit too.Brush or spray it on a warm object and let it dry at warm place.Then we must heat the object until its green colour blackens. After that we can brush it and if needed repeat the treatment.Wax or lacquer,as you wish!

2 and 3. Diferrent variants of a liver of sulphur treatment.We can take 2 grams potassium polysulphide/2 grams kitchen salt or 25 grams polysulphide/3 grams ammonia. The brass must be immersion coppered previously.Use only fresh solution!You can make gel of it, with agar agar or gelatin or methyl celulose!

4.Black on brass,immerse objects until the colour is satisfactory.Do not mix solution with acids!Deadly dangerous!

5.Matt black,immerse an object in boling solution,approximately 20 minutes.

6.Black on a copper,tombac or tin bronze.For a brass and aluminium bronze take 100 grams hydroxide.In boling solution we must add persulphate and then immerse objects.Oxygen bubbles forms during process and that is sign of the usability of solution,when this proces ends add new portion of persulphate(10 grams).Copper blackens for 5 minutes,brass need 10 minutes.

7.Bluish black on brass.Use it in well wented room.Colour forms in 14 minutes.

8.Immerse objects in boiling solution.

9.White on bronze,2 tsp,nitrate/8 oz water,apply on heated metal, only for indoor objects!

10.For copper and its alloys.Immerse an object in solution heated to 60-70 C temperature,approximatelly 20 minutes.

BROWN,YELLOW AND RED FOR COPPER + ITS ALLOYS: Cu 4

INGREDIENTS,gms/ lit. water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Copper sulphate	50		100	1,5	120	20	125		4	
Potassium permanganate	5									
Sodium chlorate		100	50							
Ammonium nitrate		100								
Copper nitrate		10								
Basic copper acetate				6		20				
Potassium aluminium						20				
sulphate										
IronII sulphate							125			
Copper oxychloride										17
Ammonium chloride										13
Sodium thiosulphate								29		
Iron nitrate								29		
Milk sugar									4	
Sodium hydroxide									4	
Acetic acid conc.										110

ADDITIONAL EXPLANATIONS: Cu 4

1.Brown on a copper/copper alloys.Heat the solution to 90 C,immerse objects 2-50 minutes.It is better to use several short immersions.Can be used at room temperature too,but then solution works slowly.

2. and 3. Olive colour /golden tinted brown on copper and bronze ,yellowish brown to orange red on brass.Immerse objects in solution heated to 90 C.Can be used at room temperature,but then works slowly.

4.Japanese red patina for golden yellow tombac.60 minutes,boiling solution.

5. For copper/copper alloys. A 5 minutes immersion in boiling solution brown or reddish brown on copper,yellowish brown on brass,yellowish red on tin bronze.Before use it must stay for 3 days,at least.

6.Japanese patina for copper and brass.Immerse objects in a boliling solution.The 5-10 minutes immersion colours brass chocolate brown,copper greenish red.Variant with 62,5 gm copper sulphate+10,5 gm copper acetate and 25 gm potassium aluminium sulphate+ few drops of acetic acid colours coinage bronze red.Variant with 60 gm copper sulphate and 20 gm potassium aluminium sulphate colours copper,tin bronze and tombac violet red,brass yellow green.Very diluted solution 6,25 gm copper sulphate and 1,25 gm copper acetate colours copper red.

7.The boiling solution colours copper violet brown,brass yellow brown.If we add 5-30 gm acetic acid the colour will be more reddish brown to violet red.

8.Red on coinage bronze.

9.Golden yellow on brass.Dissolve sugar and hydroxide in 1 liter of water,boil 15 minutes,then add sulphate dissolved in a small amount of water.Use hot solution(80 C).

9. 10.Brown,dissolve oxychloride in acid,heat it until crystals of copper acetate forms,then dilute to 4,3 liter and filter.Immerse an object in boiling solution.

COLORING OF IRON Fe 1

Ingredients,gms/ lit.water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Ethyl alcohol	90	50							30	
Nitrous ether									15	30
Nitric acid	5								19	
IronIIIchloride	35	15				10	15		30	30
Antimony(III)chloride				3		10				12
Iron sulphate		30								
Copper sulphate		12						60	15	
Sodium hydroxide			600							
Sodium nitrate			25							
Olive oil				9	2					
Tannic acid						2				
Zinc chloride					3					
Ammonia 25 %								60		
Copper chloride										18
Tartaric acid								X		

ADDITIONAL EXPLANATIONS: Fe1

1. and 2. Swiss black. Objects must be very sparingly covered with the solution.Dry them at 60 C temperature 30 minutes,or six hours at 18 C.Reddish brown coating must be without patches and bumps.Then we must immerse objects in a boling water for 30 minutes,if we want the best results 30 minutes in a hot steam and 30 minutes in a boiling water.The quality must be tested with steel wire scratch brush.Colour must be black.Repeat complete process at least 3 times.Finish with immersion in a hot linseed oil.

3. Black or bluish black.Immerse objects in a boling solution until colour is satisfactory,approximately 10 minutes.When finished rinse well,dry and immerse in a hot linseed oil.Protective clothing,gloves and goggles must be used.Modified process: first immerse objects in the next solution14 gm oxalic acid and 1,2 gm phosphoric acid,with addition of 6 gm m nitrobenzenesulphonate and 0,4 gm potassium sodium tartarate,dissolved in 1 lit water,60 second or until the object is grey coloured.After that we can immerse them in the solution made of 100 gm NaOH,35 gm sodium nitrate,5 gm sodium nitrite,5 gm sodium thiosulphate,5 gm sodium molybdate and 0,2 gm tin chloride, 1 lit water.According to USPT 6,889,769!

4. Brown colour.Heat oil in water bath,add antimonyIIIchloride,mix carefully and apply with a cottonwool or piece of cloth.After 24 hours oil and polish with piece of cloth.Repeat if needs.If we take only 1 gm antimonyIIIchloride colour will be greeenish brown.

5.Brown.Solution must be applied on a heated object.When colour is satisfactory, rinse well,dry, brush with fine steel wire brush and then oil it..

6. Dark brown.Mix it with 20 cm3 of water.When dry repeat if needs, at end of the treatment rinse well,dry and oil.

7. Reddish brown.Instead water we can use ethyl alcohol.Everytime coating must dry well.Finish with oil rubbing.

8. Black.Must be acidified with tartaric acid, A piece of cloth must be moistened with solution and rubbed on object,Finally rinse well.

9. For damascened objects.Pickle objects in a diluted nitric acid.Rinse well and rubb object with solution.Dry by indirect heat,polish with a finest steel wool,repeat the treatment 2 times every day/8 days.Finally polish it and apply wax.30 parts iron chloride= 30 parts solution,only 75 parts water!

10. Measures as in previous process,1 lit of water.Treatment as 1. and 2.

INGREDIENTS,gms / lit.water	11.	12.	13.	14.	15.	16.	17.	18.	19.	12.
Selenious acid							45			
Sodium nitrate										75
Tartaric acid						2				
Potassium permanganate								12	13	
Iron nitrate			5			2				
Zinc powder		18								
Phosphoric acid		57						2,5		
Flowers of sulphur	1									
Lard	20									
Manganese dioxide										5
Linseed oil	X?									
Silver acetate				1						
Sodium thiosulphate			35							
Copper nitrate					50					
Manganese nitrate					50					
Barium nitrate								100		
Calcium nitrate									20	
Potassium chlorate										5
Lead nitrate			10							
Oil of lavender				X						
Copper sulphate							100			
Nitric acid							50			

ADDITIONAL EXPLANATIONS: Fe 2

11. Black.Mix flowers of sulphur and lard,rubb it on object very sparingly.Heat indirectly to 200-400 C temperature. Hot air gun can be used too.Linseed oil or fat can be used instead lard.You can also use oil only too...

12. Black.Dissolve zinc in phosphoric acid,then mix 65 parts of that solution and 10 000 parts of water.30-180 minutes immersion.Rinse well,dry,rubb with oily cloth or lacquer..

13. Blue on iron and steel.Immerse objects in hot solution(70 C).

14.Green.Take 1 part of silver acetate and 20 parts of oil of lavender,mix well,rubb on the object and then heat object to 150 C.

15. Blue. Immerse objects in a heated solution(50 C).When colour is developed, stop process and rinse well.If we take 75 gm manganese nitrate, colour will be more intensive.

16. Black .It must be rubbed on object. Stronger solution can be used too(20/20).

17.Brilliant black.Immerse objects in the solution until colour is developed.If we take more selenious acid, colour will be bluish black.

18.For iron and steel. The temperature of solution 94- 98 °C.Immerse objects in solution for 40-60 minutes.

19.For carbon steel. Immerse objects in solution,when colour is developed rinse well.

20.Bluish black.Immerse objects in the boiling solution.

CHEMICAL COLOURING OF STAINLESS STEEL

INGREDIENTS,gms / lit.water	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
Sulphuric acid			50	50		50	25		1L	400
Ammonium metavanadate				10						
Sodium polysulphide	30									
Potassium permanganate	20		125							
Sodium sulphate	10									
Sodium hydroxide	800									
Phosphoric acid		5-50								
Oxalic acid					100					
Sodium thiosulphate						200		248		
Potassium dichromate									13	
Nitric acid							14			
Lead acetate								76		
Phytic acid										250

ADDITIONAL EXPLANATIONS: Fe 3

21.Black. Immerse objects in the boiling solution for 10-15 minutes .Rinse well,dry,oil or wax.

22. Different colours,depends on how long we immerse objects in boiling solution, 20 minutes golden bronze,60 minutes indigo blue,120 minutes turquise,180 minutes green.According to USPT 2,521,580.

23. Black.Only 25-49 parts of water!Immerse objects in boiling solution.According to USA patent USPT 2,219,554

24.Black ,brown or golden.Only 40 parts water!Immerse objects in boiling solution. According to USA patent USPT 2,283,171

25.Black.Immerse objects in the hot solution,then rinse and immerse in 1% sodium sulphide solution.

26.Black.Acid in mll!Immerse objects in lukewarm solution until colour is developed.

27. Black.Measures in volume parts,add 20 parts water.Immerse objects in the boiling solution(90-100 C) for 15-45 minutes.

28.Dark blue to black.Dissolve every componet in one liter of the water and then mix them before use. Solution must be hot(60 C).

29.Black,according to Naylor.Specific density of acid 1,55gm/ cm3.Temperature 18-25 C.Duration 5-10 minutes.. Potassium dichromate is carcinogenic compound!

30.Black.Add 200 gms sodium hyposulfite.Immerse objects - 80 C,20 minutes.According to patent CN103114283A

CHEMICAL COLOURING OF SILVER: Ag

ingredients,GMS/LIT WATER	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Potassium polysulphide	10									
Sodium nitrate			10							
Copper sulphate			20			10	30			
Ammonia 25 %			20							
IronIIIchloride		500								
Sodium hydroxide		20								
Graphite				6						
Hematite				1						
Iodine					1					
Hydrohloric acid					3			300		
Ammonium chloride						5			950	4
Vinegar						100				
Sodium chloride							15			16
Sulphuric acid								100		
Potassium hydrogentartarate										12
Copper nitrate										20
Copper acetate									200	
Turpentine								200		

ADDITIONAL EXPLANATIONS : Ag

1. Dark grey,bluish.Immerse objects in the solution,room temperture.Take not more than 50 gm sodium or potassium polysulphide.Hot solution can be used too,then colour development is faster.

2. Dark grey to black.We must make 2 solutions,every one in 1 liter of water.Solution 1. iron chloride,solution 2. sodium hydroxide.Immerse objects in solution 1. for 5 seconds,then rinse well and immerse in solution 2.(it must be hanged on aluminium or zinc wire).Then rubb it with fine pumice or chalk and wax or lacquer it.

3.Brown.Immerse objects in the solution,when they are coloured rinse well,dry and wax.

4. Patina on silver.Mix hematite , graphite and turpentine.Paint that mixture on objects,when they are dry rinse well and rub it with cloth moistened with alcohol.

5. Green oxide.Three parts acid and one part iodine must be mixed together,then immerse objects in the solution and when colour is developed rinse well and dry.After some time it blackens.

6. Brown.Immerse objects until colour is developed.

7. Grey.Only 1 dl water!Immerse objects in the solution until colour is satisfactory.

8. Patina on silver.Slowly add acid to turpentine and then add hydrochloric acid.Paint objects with the solution,after every application rinse well!

9. Green on grey background.Rubb object with the cloth moistened with solution,twice every day for 5 days,then it must be dried for next 5 days.

10. Dark brown.Take as little water as possible,result must be the thick paste!Rubb it on object,after 4 hours rinse well and dry..

CHEMICAL COLOURING OF ZINC: Zn

INGREDIENTS,gms / lit.water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Copper sulphate	125	35	12	50						
Potassium chlorate	60									
Ammonium chloride				25	50	60				
Copper chloride					50					
Hydrochloric acid(50%)					50					
Nickel sulphate						60				
Sodium hyposulphite							80			15
Sulphuric acid(60%?)							30			
Chromium aluminium sulphate										25
Ammonia 25 %				50						
Potassium permanganate			15							
Ammonium molibdate								20		
sodium acetate								5		
Sodium hydroxide		150								
IronIIIchloride									200	
Potassium bitartarate		35								

ADDITIONAL EXPLANATIONS: Zn

1.Black.Ingredients must be dissolved in hot water,then filter and use.Immerse objects and take them out immidiatelly.Colour developes after contact with air.Repeat if needs,rinse well and dry.

2. 2. Zinc lustre colours.Immerse objects in cold solution,when colour is satisfactory rinse well and dry.Wax or lacquer.

3. Black.Immerse objects in heated solution(90 C).

4. Brown.50 cm3 ammonia.Objects must be painted with the solution and then scratch brushed with fine brass wire brush.

5. Black.Paint it on objects.

6.Blue.Immerse objects in the solution.If we take nickel sulphate instead nickel ammonium sulphate colour will be violet blue.

7. Green.Dissolve hypo in the water,when the solution is cleared add acid,result will be milky fluid,after that filter it and it is ready for use.Filtered solution must be clear ! Immerse objects in the boiling solution.

8. Black.Instead acetate we can use sodium thiosulphate.Immerse objects in the solution.

9. Greyish black.Immerse objects in the solution(approximatelly 20 minutes).

10. Greenish brown.Dissolve ingredients in 0,5 liter water.Objects must be painted with solution.When the colour is satisfactory, rinse well.Longer immersion will produce almost black.

DIRECT CHEMICAL COLORING OF ALUMINIUM Al 1

INGREDIENTS,gms/lit water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Potassium permanganate	10			20						
Copper nitrate	25									
Ammonium molybdate		10								
Sodium thiosulphate		5								
Nitric acid 38 Be	4									
Sodium chromate								10		
Sodium carbonate calc.								4		
Potassium polysulphide					25					25
Potassium bichromate					0,3					
Vanadium sulphate										1
Alizarine					1					
Antimony(III)chloride						100				
Manganese oxide						50				
Hydrochloric acid						200				
Methylated spirit						1L				
Potassium hydroxide								4		
Egg white									X	
Potassium ferrocyanide			5							
Iron III chloride			5							
Platinum chloride							10			

ADDITIONAL EXPLANATIONS: Al 1

1. Brown to black(according to Krause).Temperature of the solution 80-100 C.Immerse objects - 5 minutes light brown,15 min. dark brown,30 min. black.

2. Black.Temperature of the solution 100 C.Immerse objects in the solution.

3. Blue.Immerse objects in solution until colour is developed,70-80 C.Unstable solution-must be used fresh !

4. Golden yellow.If we add 5 gm of manganese sulphate brass colour.Use of copper sulphate instead will produce bronze colour.

5. Red.Objects must be immersed at least 30 minutes,temperature of the solution 80-90 C.

6. Black.Objects must be previosly pickled in 80 % sulphuric acid.Then rinse well and immerse in the solution.Rinse in a hot water,dry,lacquer.

7. Black.Platinum chloride must be dissolved in 100 mll water or alcohol.Expensive!

8. Grey.Mix ingredients with 10-15 gm water.Paint it on objects and after 20 minutes(30-40 C) rinse well and dry.Potassium chromate is carcinogenic compound!

9. 9.Dark brown to black. Paint it on objects and then heat it to 350-400 C (indirectly).Repeat it if needs.Linseed oil can be used too.

10. Brown to black.Same process as 5.

COLOURING OF OXIDIZED ALUMINIUM

INGREDIENTS,gms /lit. water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Cobalt acetate	20									
Potassium permanganate	20							10		
Lead nitrate		50								
Potassium chromate		50								5
Copper sulphate			25		X					
Ammonium sulphide			1			X			X	
Iron(III)sulphate				50						
Potassium ferrocyanide				25	X					
Lead acetate						X				
Cobalt acetate							40			
Sodium polysulphide							15			
Sodium thiosulphate								10		
Cadmium acetate									X	
Silver nitrate										X
Iron(III)ammonium oxalate								X		

ADDITIONAL EXPLANATIONS: Al 2

Before colouring aluminium must be oxidized chemically or electrochemically(anodized).Colours develops by chemical reaction.

Chemical oxidation: 25% waterless sodium carbonate and 0,5-2,5% sodium chromate.Ingredients must be dissolved in 1 liter of water(add second only if the first is dissolved).Degreased objects must be immersed in a boiling solution,35 minutes.Because sodium chromate is carcinogenic compound we can use next alternative processes - sodium aluminate based (20-60 gms aluminate, 0,2-0,6 gms tannin,1 lit water,70-100 C, 20 minutes- according to USPT 2,146,838) and ferric citrate based(0,1 - 0,5 M ferric citrate, 0,1-0,5 M trisodium phosphate and 0,1-0,5 M potassium carbonate, 1 lit water,pH 11-13,temp.75-100 F ,30 minutes,according to USPT 4,212,685). After that step rinse objects well and immidiatelly colour them!

Anodic oxidation: Solution of 230 gm sulphuric acid/1 lit.water,at least 12 V,current density 1 A/dm2,cathode= lead plate,anode= object .An object connected to the positive pole of transformer must be immersed in the solution ,in which lead plate connected to negative pole must be previously immersed,15 -60 minutes.Then rinse well and colour immidiatelly.According to literature instead special aluminum dyes cottonwoll dyes can be used too.Finish with boiling in water for 30 minutes(after colouring)!!!.

1. Bronze colour. Immerse in acetate(up to 50 gm) solution ,rinse well and immerse in the permanganate solution(up to 50 gm),rinse again.35-50 C.

2.Yellow. Immerse in nitrate(up to 100gm),rinse well and immerse in the chromate solution(up to 100 g),finally rinse again.Chromate is carcinogenic compound!

3.Green.Immerse in the sulphate solution,rinse and immerse in the sulphide solution,rinse again.

4.Blue. Immerse in sulphate,rinse,immerse in potassium ferrocyanide,rinse again(50 C).

5.Reddish brown.Immerse in sulphate,rinse and immerse in ferrocyanide solution,rinse again.

6.Dark brown.Immerse in an acetate solution,rinse and immerse in sulphide,rinse again.

7.Black.Immerse in an acetate solution(up to 100 gm),rinse well, immerse in sulphide(up to 25 gm),rinse again.

8.Golden yellow.Immerse in the thiosulphate(up to 50 gm),rinse,immerse in a permanganate(up to 50 gm),rinse again.

9.Yellow. Immerse in acetate,rinse well,immerse in sulphide,rinse again.

10.Orange. Immerse in chromate,rinse well and immerse in nitrate(up to 10 gm),rinse again.Chromate is carcinogenic compond!

COLOURING OF TIN,LEAD AND NICKEL

INGREDIENTS,gms / lit.water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Sodium thiosulphate									10	
Bismuth nitrate	5									
Nitric acid	50									
Tartaric acid	80									
Ammonium chloride		30		3	32					
Molybden acid		7,5								
Iron III chloride			200							100
Copper acetate				12						
Vinegar				20						
Copper sulphate						20	X			
Hydrochloric acid									X	500
Potassium bichromate					7,5					
Potassium permanganate						5				
Acetic acid					31					
Potassium rhodanide								0,5		
Sulphuric acid, ccm								5		
Hydrogen peroxide 30 %, ccm								25		
Chromic acid					6,25					
Copper nitrate					62					
Potassium hydrogentartarate							X			

ADDITIONAL EXPLANATIONS: tin,lead,nickel

1. Black on tin.Nitric acid in ccm,tartaric in grams.Immerse objects in heated solution(70 C).When colour is developed rinse well,dry and wax.

2. Black on tin.Immerse objects in the hot solution.

3. Greyish black on tin.Immerse objects in the solution.

4.Bronze brown on tin.Dissolve ingredients in 0,5 lit water acidified with nitric or hydrochloric acid.

5.Green patina on lead.A temperature of the solution 3540 C.Copper nitrate 62,5 gm!

Potassium bichromate is carcinogenic compound!

6. Brown on lead.A temperature of the solution 7080 C/ 15 minutes

7. Bronze colour on tin.Mix diluted solution of copper sulphate and cream of tartar,Rubb it on an object.

8.Black on nickel.Immerse objects in the cold solution(15 C).Use only fresh solution!

9. Rainbow colours on cristalline etched tin plated steel.10 parts tiosulphate/120 parts water!Pour acid on object , then without rinsing imerse it in thiosulphate solution.

10.Black on lead.Acid in mll!

LUSTRE(INTERFERENCE) COLOURS

INGREDIENTS,gms / lit.water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Sodium thiosulphate	50	240	100	250			280			
Lead acetate		25	10							
Antimony(III)sulphide										
Copper sulphate	74		12						36	30
Nickel sulphate						60				
Potassium sodium tartarate			12							
Potassium hydrogentartarate	25	30								30
Acetone (mll)				25						
Copper acetate				60			25			
Sodium hydroxide					100			83	150	
Basic copper carbonate					200					
Ammonium chloride						60				
Citric acid							30			
Potassium hydroxide										180
Copper tartarate								62		
Tartaric acid									30	

ADDITIONAL EXPLANATIONS: Lustre(interference) colours

1. For brass.Pink blue black(one after another).Immerse objects in the hot solution.

2. For copper/copper alloys,iron and steel(blue,black,brown),silver,nickel,gold,platinum.Colour sequence on brass:golden yellow -copper- violet -dark blue- light blue -chromium like - nickel like-reddish grey. Temperature 25 -30 °C.

3. For stainless steel: 1 lit water, 18-22 °C temperature of solution, 5–50 minutes, yellow, brown, red, green, blue, violet, object must be in contact with piece of copper 300 times smaller surface than surface of treated object.According to ex USSR patent SU 815081

4. For tin and pewter.Hot solution (45 -85 C).1 - 20 minutes.Golden,rose,blue,green.According to USPT 9,163,312 B2

5. For brass.Golden yellow-orange-carmine red.Do not lacquer!

6. For zinc.Yellow-brown-purple-violet-indigo blue.

7. For brass.As 2.The solution must stay for 4 days, before use

8. For zinc.At 10 C temp.:2 minutes violet-3 minutes blue-4,5 minutes green-6,5 minutes yellow-8,5 minutes purple red.Do not lacquer!

4. 9. For zinc.Rainbow colours.Use cold solution.Dissolve sulphate,then add acid and as last hydroxide.

10. For brass.Rainbow colours.Hot solution.

INGREDIENTS,gms / lit.water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Sodium bicarbonate	100									
Copper sulphate		23				70	96	5-15		
Potassium bichromate		89								
Ammonium chloride			40							
Sulphuric acid									1 L	
Potassium sodium tartarate						160				
Potassium hydroxide						300				
Sodium hydroxide				25			108			
Lactic acid							150			
Lead nitrate				25						
Borax								125-150		
Sodium bichromate									7,5	200
Sodium sulphate										5
Phosphoric acid					X					

ADDITIONAL EXPLANATIONS:Electrolytic colouring /I

1. Green on copper.Object =cathode,anode=stainles steel,40 v,15 A/dm2. Potassium or sodium carbonate can be used too.Voltage and current density can be much weaker.
2. Yellow green on copper.Object=cathode,6 v,undefined current density.Potassium bichromate is carcinogenic compound!If we use a solution of ammonium nitrate and sodium nitrate(50 gm/50 gm) the colour will be blue green.1 A/dm2, max.4 v
3. Red and green on copper/copper alloys.2 v,object = anode
4. Green on gold and gilt objects.Dissolve every component in a half liter of the water,then mix solutions together.Object=anode,cathode=stainless steel or platinum.Small cathode(needle),big anode.Distance between electrodes 1 cm.15 minutes.Colors platinum blue.If we use the lead acetate solution(100g/lit) result will be Nobilis rings(rainbow colored rings)if anode is gold or gilt.Other usable solutions:manganese sulphate(50 gm/lit),ammonium sulphate(25 gm/lit),manganese acetate(67 gm/lit),manganese chloride(125 gm/lit)copper acetate,
5. For titanium,colours depends on voltage,stainnless steel cathode,object is anode. Straw yellow/10 v purple/29v blue/30v blue green/45 v light green/55 v purple red/75 v grey/110v
6. Black on copper.2-4 A/dm2,20 minutes,object=anode,cathode stainless steel
7. Different colours on copper.Violet,blue,green,yellow,orange,red.Voltage 0,25 v,current density 0,15/Adm2.Object=cathode,anode copper.There are other formulas too:copper sulphate 40/45/50/,hydroxide 35/40/50,sugar 85/90/100gm/lit.A solution of 60 gm copper sulphate/50 gm hydroxide/100 gm sugar is another possible option.Or solution of 100 gms copper sulphate / 355 gm citric acid/ 246 gm NaOH.Or 15 gm copper sulphate and 150 gm borax.

8. Different colours on etched tin plated steel or pewter.Dissolve sulfate in 0,2 lit water,dissolve borax in 0,8 lit water,then slowly add sulfate solution to borax solution ,mixing vigorously during process.Yellow-green-red-blue.35-40 C.Current density 0,005-0,010 A/dm2.Duration 3-20 minutes.Anode copper.According to ex USSR patent SU 114163

9. For stainless steel(CrNi 18/8).object =anode,cathode lead.70-95 C.1,3v. 0,06 A/dm2.5-50 minutes.

Colour sequence:brown-blue-yellow-red brown-purple-green Sodium bichromate is carcinogenic compound!According to Russian literature after processing items should be soaked in a solution of potassium bichromate (5-10%), 5-15 minutes, 70-90 C temperature of the solution. According to one chinese patent treated objects can be then immersed in a hot diluted sodium silicate solution (1-5%,95 C,3-10 min.). Hexavalent chromates are carcinogenic and toxic, molybdate-based solutions are now being proposed as a substitute(for example molybdate 30-100gms/boric acid 10-18 gms/manganese sulphate 0,5 -5 gms/1 lit water) According to chinese patent CN101173367B

10.Black on zinc.Object=anode,pH 2,5-4,5.0,55 A/dm2.1,5-4 v.Temp.15-25 C Sodium bichromate is carcinogenic compound!

ELECTROLYTIC COLOURING/ II

INGREDIENTS,gms / lit. water	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Potassium hydroxide	300									
Ammonium sulphate		100								
Nickel sulphate			75			23				
Nickel ammonium sulphate			45		100					
Zinc sulphate			37							
Sodium thiocyanate			15			30				
Chromic acid				40						
Acetic acid conc.				28,2						
Barium carbonate				1						
Sodium thiosulphate					10					
Sodium citrate					15					
Copper acetate								10		
Gelatine								3		
Sodium hydroxide									300	
Sodium stannate							35			
Sodium lactate						400				
Sodium chloride						50				
Sodium hydrogen phosphate										100

ADDITIONAL EXPLANATIONS: Electrolytic colouring/II

11.For stainless steel,boiling solution,cathode=stainless steel,15 minutes,up to 0,4 A/dm2 ,golden,brown,red,blue

12.For niobium,object=anode,cathode stainless steel,colours depends on voltage violet/1516 v+blue/20 v+yellow/50 v+magenta red/60 v+turquise/80 v+pink/ 100 v Danger!Potentialy deadly voltage!Use rubber gloves!

13.Black nickel,pH 5,6-5,9,up to 2 A/dm2,55 C temp.,0,5-1,5 v.Nickel anode.

14.Black chromium,measures in ozs/gallon water.Up to 20 A/dm2.Hex chromium compounds are carcinogenic!Today we can use trivalent black chrome:Chromium chloride 266 gms/cobalt chloride 15 gms/H2SiF6 8-12 gms/NaH2PO4 4 gms/NaF 21 gms/25 C /20-50 A/dm2

15.Green nickel.pH 6,4.Up to 1,5 A/dm2.Blue nickel: 30 gms ammonium sulphate/50 gms nickel sulphate/40 gms nickel ammonium sulphate/40 gms zinc sulphate/20 gms potassium tiocyanate/0,5 gms butylene 1.4 diol.Temp.50 C.Nickel anode.

16.Different colours for zinc,aluminium,copper,brass,steel.Add up to 2,4 gm zinc chloride.Sodium chloride 0-100 gr.Sodium lactate in mll!27 C.Up to 0,12 A/dm2.According to USPT 6,800,190

17.Different colours for tin/pewter.Add 25 gms sodium hydroxide,object as anode,20C / 5 A/dm2 /40 sec.According to german patent D.R.P. 260 304

18.Bancrofts blue on copper.Anode and cathode copper.0,45 A/dm2.Cathode must be covered with gelatinous brown coating,then rinse well and immerse in 50 gm copper acetate/1 lit. water solution,blue colour will be formed.It must be lacquered!

19.Different colours on steel.First we treat object as cathode for 2 minutes(coal anode),and then next 5 minutes as anode.Voltage 0,5-2 v,current density up to 5 A/dm2.Violet,blue,red brown,yellow.According to USPT 1,342,910

20.Black on tin.Add 10 mll phosphoric acid(1,75 gm/cm3).90 C,6 minutes,cathode copper,3-4 A/dm2.If we use lower current density result is porous and dyable coating (can be used for cyanotype or cuprotype too)!

JAPANESE PATINAS

INGREDIENTS,gms / lit. water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Copper acetate			40			30				
Copper sulphate	50	5			30					3
Lime							35			
Vinegar	1 L								1 L	1L
Sulphur							100			10
Sodium chloride	10									10
Rokusho		5								
Iron cuttings									200	
Ammonium chloride		2,5		3	3	3		40		
Calcium chloride								25		
Sodium hydroxide			14							
Calcium carbonate			14							

ADDITIONAL EXPLANATIONS: Japanese patinas

Important!

We must use copper or pyrex glass (add some copper cuttings) pot for heating of solutions.Only copper or wooden tools must be used,any contact with iron must be avoided!

1.Sutanpan,mainly used as base for other colours,can be used for colouring of copper/copper alloys,violet to bluish black on shibuichi,silver(dark grey),zinc(black).Instead vinegar we can use water too.Immerse objects in hot or cold solution.

2.Niage,mainly used as base for other colours,light green on brass,matt black on copper,ligt to dark grey on shibuichi(japanese alloy,75 parts copper/25 parts silver),can be used without ammonium chloride too.Immerse objects in cold or hot solution.

3.Rokusho,important ingredient of japanese patinas,instead it we can use described solution as substitute.Dissolve compounds in water,then after 7 days filter it and use filtrate as rokusho substitute – 30 gms must be obtained/more or less.

4.Enka,for copper/copper alloys,green to yellow green.Use 1.or 2. as base.Immerse object in hot solution

5.Ryusando,for copper/copper alloys,green to blue green,use 1. or 2. as base.Brush it on object.

6.Sakusando,light blue for copper/copper alloys.Use 1. or 2. as base.Brush it on object.

7.Ryoka,for copper and silver(bluish black).Immerse object in solution.

8.Furubi,black for silver.Immerse objects in solution.

9.Ohagura,heat cuttings to red glow,then drop it in vinegar,after 5-6 months standing we can use solution,we must use solution as concentrate which must be diluted with 4 parts water.For copper/copper alloys(reddish colour on bronze),iron and steel(grey to black).

10.Sabitsuke,for iron and steel,brush it on object,when colour is Ok rinse well in baking soda solution,finish with wax or oil.

HEAT COLOURING OF METALS

Very simple process.A metal must be heated to the specific temperature,when the colour is developed , the process is ended.A heating must be, in principle,indirect(without contact with a open flame).A kiln with precise temperature control must be prefered .Hot air gun can be used too.

1.HEAT COLOURING OF IRON AND STEEL

yellow/228 C brown/254 C purple red/265 C light blue/264 C dark blue/ 293 C

2.HEAT COLOURING OF STAINLESS STEEL

light yellow/290 C brown/390 C purple/450 C blue/540 C dark blue/600 C

3.HEAT COLOURING OF TITANIUM

light yellow/371 C purple/412 C blue /440 C light green/510 C brownish grey/635 C

4.HEAT COLOURING OF COPPER/COPPER ALLOYS

When we heat copper or its alloys to 161-341 C interference colours develope

first.Sequence :light brownish orange reddish brown orangerose reddish orange rose red rose reddish violet purplish blueviolet white steeel white yellowish white brass yellow dark yellow meat red pinkish blue bluish green. At higher temperatures(more than 600 C) red and black oxides.

5.HEAT COLOURING OF DIFFERENT METALS IN BLACK

This treatment can be used on any metal,if it can be heated to 200-400 C.It was used in the Late Middle Ages on copper (email brun,schmelzfirnis) and iron or steel(Romans).Metal must be rubbed with linseed oil(very sparingly) and heated slowly to 200-400 C.Repeat if needs.Instead oil we can use 20 % shellac solution.

Other oils can be used too(sunflower,olive,peanut,soy).

A few forgotten but interesting procedures

1.Moire Metallique

That procedure has been used from the early 19th century(patented 1817.in UK/L.F.Vallet patent #4146) . It can be done on tin plated steel or aluminium . Tin plated steel must be heated until tin is melted,when cold it must be treated with a mixture of 1 part of the nitric acid, 10 parts of sulfuric acid and 89 parts of water. 3-5 % hydrochloric acid or diluted aqua regia can be used too.Formation of a visible crystalline pattern must be result. In the former Soviet Union A.P.Eitchis revived process under name Kristallit ,he dedicated book to it(Kristallit,Kiev 1961.)and patented electrochemical colouring process for crystalline etched tin plated steel(SU 114163).

2.Jesse E. Starack's patent US 2,313,456

We must cover object with copper oxide electrolytically, and then reduce this layer electrolytically too , process depends on the applied voltage and we can get moss like, spider web like or crystalline patterns. 200 ccm/sodium carbonate 20 gms/sodium hydroxide 30 gms/aldol 0.25 - 1.5 gms/water 1 lit. / 0.4 - 0.5 V/ 3 minutes duration

Reductive solution:NaOH 7.5 - 60 gms/ Na2CO3 0 - 120 gms/ NH3 0.2 - 5 gms/ sodium nitrate 0 - 10 gms/ water 1 lit./15 - 21 C temp. 2-2,5 v ,or 2 - 4 v or 4 - 16 v ...

3.Aladar Pacz's patent US 1,614,684

A solution that creates abstract patterns and shapes on treated aluminum sheet. 0,15% sodium silicofluoride/ 0,3% nickel sulfate/ 1 % amonium nitrate - 80 C temperature of solution.

4.Krom ahat - ex USSR patent SU 87273 patented 1949.

Special variant of black chrome.300-400 gms chrome anhydride,5-10 barium acetate,2-5 zinc acetate,4-8 calcium acetate,20-40 C,30-100 A/ dm2,6-9 v,10-20 minutes,3-10 cm distance between electrodes,black fields and white lines.

5.Sloit process (USSR patent SU 293879 patented 1971.,A.P.Eitchis)

Proces for production of gray to black horizontal stripes on zinc or zinc plated steel,thin layer of electrolyte floats on inert liquid,with special plating tank with anode tank separated and a bit higher then main tank with inert liquid.Electrolyte NaOH 50 -100 gms/potassium bichromate 5 -10 gms/water 1 lit,inert liquid perchlorethylene.

DEGREASING

INGREDIENTS,gms / lit. water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Gasoline	X									
Alcohol		X								
Acetone			X							
Trichlorethylene				X						
Sodium hydroxide					100	15	15			70
Sodium carbonate						10			100	130
Trisodiumphosphate						10		50		
Sodium gluconate						20	15			
Polyglycolic ethersulphate							0,8			
Waterglass								8	8	

ADDITIONAL EXPLANATIONS: Degreasing

1.,2.,3.,4. Solvent degreasing.1., 2., 3. flamable ,4. not flamable but toxic.Mixture of gasoline and trichloroethylene not flamable but toxic too!

5. For copper and its alloys,iron,silver,gold and nickel.immerse objects in a boiling solution.Safety goggles and rubber gloves must be used.Very harmful for the skin and mucous membranes.After degreasing rinse well and then brush with lime and chalk slurry.Then rinse well again with water,and then with diluted citric acid(35-50 gm/lit.).Rinse once more and dry.

6.For copper and its alloys.Same process as 5.,temperature of the solution 70-80 C,duration 3-4 minutes.

7.Electrolytic degreasing for copper and its alloys.!0,5-2,5 A/dm2,30 C,voltage 6 v.Simple electrolyte can be used too(50 gm sodium hydroxide or 25 gm sodium hydroxide)

8. and 9. Same as 7.For aluminium,tin(8.),zinc,lead.

10. Electrolytic degreasing.Treatment same as 7.

PICKLING,CHEMICAL POLISHING,MATT FINISH / I

INGREDIENTS,gms / lit.water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Sulphuric acid	100				1L	0,1	11		30	60
Phosphoric acid		100					78			
Nitric acid				1L	1L		11			
Hydrochloric acid			50	10	20					
Soot					5					
Oxalic acid						25				
Hydrogen peroxide						40			60	
Iron IIsulphate							0,8			
Sodium hydroxide								200		
Sodium bichromate										200
Sodium chloride										
Water	1L	1L	1L	No	No	1L		1L	800	1
Ethyl alcohol									20	

ADDITIONAL EXPLANATIONS: Pickling,chemical polishing ,matt finish/l

1.For iron and steel,copper and its alloys,silver,zinc(20-50 mll/lit only).We can add up to

1 % of the scotch glue or gelatine.You must slowly add acid to the water!

2. For iron and steel.

3. For tin.

4. For copper/copper alloys.Prepickling before polishing.

5. For copper and its alloys.Chemical polishing.Work under strong ventilation.Slowly add sulphuric to nitric acid,soot and hydrochloric acid must be aded last,when the solution is cold.The gas formed during the application is toxic.If we add 5% zinc sulphate the result is matt finish.

6. For iron and steel,chemical polishing.Use only fresh solution!

7. For aluminium,chemical polishing.Phosphoric acid density 1,75,nitric 1,42,sulphuric 1,84.95-100 C.15-60 seconds..

8. For aluminium,we can add 30 gm sodium chloride.

9.Chemical polishing of copper/copper alloys.No toxic gas!Only 800-890 mll water!

Peroxide 60-150 mll.Use only fresh solution!

10. Matt finish for copper and its alloys.Before use keep it 24 h/30-40 C.No toxic gas!Chromium compounds are carcinogenic,use rubber gloves!

Pickling,chemical polishing,matt finish/II

lNGREDIENTS,gms /lit. water										
	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Sulphuric acid			3			10				
Nitric acid	X					5		50		
Hydrochloric acid		X		200		10				
Water					800	75			45	
Thiourea			25							
Phosphoric acid					200					
Acetic acid			10							
Ethyl alcohol				700						
Glycerine				10						
Iron(III)chloride							300			
Formic acid									10	
Trisodium phosphate										50
Hydrogen peroxide 30%									45	
Sodium hydroxide										160

ADDITIONAL EXPLANATIONS: Pickling,chemical polishing,matt finish/II

11.For austenitic stainless steel. Acid concentration 25 %,55-65 C temp. You must work in a well wentilated room!

12.For austenitic stainless stell. Acid concentration 30 %.

13.Gold electropolishing.Temp. 50-60 C,13 minutes,current density 1,5-3,5 A/dm2,object= anode

14.Silver electropolishing .Duration 20 seconds,current density 1,5 A/ dm2,object= anode,measures in mll,without water!

15.Copper electropolishing. Acid in grams,water in mll,object=anode

16.Chemical polishing of the stainless steel,in volume percents,add 10 gm soot,temp.80 C!

17.For steel wire,1000 cm3 water!

18.For magnesium sheet,not for cast objects!

19.For nickel,in volume percents!

20.Satin finish for aluminium. Up to 260 gm hydroxide,sodium nitrate 120-160 gm,dextrine 1 gm,trisodium phosphate up to 80 gm. Temp.70-80 C. Duration 30-60 seconds!

IMMERSION PLATING / I

INGREDIENTS,gms / lit.water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Tin chloride	15								5	
Sodium sulphate	160									
Hydrochloric acid	X									
Sodium hydroxide			200							
Nickel sulphate										250
Sodium chloride					20	30				
Basic copper carbonate		X								
Silver chloride					10					
Potassium carbonate						30				
Potassium nitrate							1			
Copper sulphate								20	5	
Potassium ferrocyanide						30				
Gold chloride						7	7			
Ammonia 25 %								50		
Tartaric acid								X		
Zinc powder			X							
Silver nitrate				15						
Sodium thiosulphate				30						
Ammonium chloride		X		10			3,5			250
Potassium bitartrate					20					

ADDITIONAL EXPLANATIONS: IMMERSION PLATING / I

1. Tining of iron.Dissolve ingredients,add a few drops of acid.Immerse objets on perforated zinc sheet and cover them with zinc cuttings.Duration 45 minutes.

2. Brassing by friction.Take 10 parts saturated ammonium chloride solution and 1 part basic copper carbonate.Rubb it on the object.

3. Zinc plating for copper.In a boiling lye add zinc dust in a small portions,until some zinc dust stayed undissolved.Hang object in the solution until zinc coating is satisfactory.

4. Bright silvering for copper and copper alloys.Dissolve nitrate in 50 gm water,add ammonium chloride dissolved in the same amount of water,and at the end add sodium thiosulphate solution(in 900 mll water).Immerse objects in the solution,bigger objects must be splashed or sprayed.Brush objects with fine brass wire scratch brush, which is previously immersed in the soapy water or stale beer.Rinse well.Keep in dark bottle.

5. Silvering paste for copper and copper alloys.Mix thoroughly dry ingredients,add the smallest possible amount of water and rubb it on an object with a piece of leather , cork or cloth.Rinse well and brush with fine brass wire previously immersed in the soapy water or stale beer.Rinse well and lacquer as soon is possible.

6. Gilding for copper and copper alloys.Dissolve chemicals one after another,gold chloride last.Immerse objects in a hot solution,rinse well,brush them with fine brass wire brush, previously immersed in soapy water or stale beer,rinse well,dry and lacquer.Never try to mix the solution and acids!Deadly dangerous!

7.Gilding powder.For silver an copper/copper alloys.Dissolve chemicals in 200 ccm water,moisten small linen cloth with solution,and when it is dry burn it.Obtained ash is gilding powder with piece of cork moistened with vinegar take some powder and rubb it on an object.Rinse well,brush with fine brass wire brush previously moistened with soapy water or stale beer,rinse again,dry and lacquer.

8. Coppering of iron and steel.Add tartaric acid until pH is 3,5!
9. Bronze finish for iron and steel.
10. Nickeling of copper.Temperature of the solution 100 C,objects must be hanged on aluminium or zinc wire.

INGREDIENTS,gms / lit.water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Ammonia 25 %	50								5	
Sodium chloride		140								30
Platinum chloride		10								
Sodium hydroxide		X	90		80					
Zinc sulphate			50							
Copper sulphate	30			20	30					
Sulphuric acid				10						
Potassium sodium tartarate					150					
Copper tartarate						50				
Tartaric acid	50					X				
Potassium bitartrate							20			
Zinc chloride							10			
Nickel ammonium sulphate								20		
Ammonium chloride								40		
Nickel sulphate										60
Sodium carbonate										10
Nickel chloride									60	
Tin chloride									30	
Iron(III)chloride									10	

ADDITIONAL EXPLANATIONS: Immersion plating/II

1.Coppering for zinc.Immerse objects.When copper coating is formed take it out and rinse well.50 ccm ammonia.

2.Platinizing for copper and copper alloys.Dissolve salt in a hot water,add platinum chloride,add hydroxide ,until pH is 9.Immerse objects in the hot solution.

3.Zincing of aluminium.Dissolve zinc sulphate in 1 lit. water,dissolve hydroxide in 1 lit water,mix solutions and immerse objects in the hot solution(50 C),objects must be moved in solution,duration 20 seconds.

4.Coppering of iron and steel.Immerse objects(4 seconds).Rinse well.

5.Coppering for tin and pewter.Dissolve tartarate in a half liter of water,add hydroxide,in another half liter of water dissolve sulphate,mix solutions and immerse objects hanged on aluminium or zinc wire.The temperature of solution 90 C.

6.Coppering for aluminium.The solution must be acidified with tartaric acid,pH 3,5/temp.100 C.

7.Zincing of iron and steel.Immerse objects in hot solution.

8.Nickeling of iron and steel.Correct pH to 9(with ammonia),then acidify with tartaric acid,ph must be 3.Immerse objects hanged on aluminium or zinc wire.

9.Nickeling by friction.The solution must be acidified with few drops of sulphuric acid.Moisten piece of cloth with solution,take some fine zinc fillings and rubb it on an object.Rinse well and dry.For copper and coppered iron or steel.

10. Nickeling of zinc.Immerse objects in heated solution.Dilute if works too fast.

ELECTROPLATING /I

INGREDIENTS,gms / lit. water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Copper sulphate	250									
Sulphuric acid	75					2,5				
Copper pyrophosphate		110								
Potassium pyrophosphate		400					100			
Zinc sulphate			200							
Sodium sulphate			50							
Tin chloride				17						
Sodium phosphate				35						75
Nickel sulphate					68					
Sodium citrate					35					
Chromic acid						250				
Silver pyrophosphate							25	20		
Ammonium carbonate							25			
Potassium ferrocyanide								40	15	
Potassium carbonate								40	15	
Gold chloride									4	1
Aluminium sulphate			30							
Sodium sulphite										2,5
Boric acid					1					
Dextrine			10							
Ammonia 25 %								1		

ADDITIONAL EXPLANATIONS: Electroplating/I

1. Acid copper plating.Can be used for electroforming.3-5 A/dm2.Voltage 2-6 v.Temperature 30-40 C.Copper anode.

2. Pyrophosphate coppering.Add 19 gm citric acid and 3 gm ammonia(25%).Copper anode.

3.Acid zinc plating.2 A/dm2, 3-4 V,temp.20 C, anode electrolytic zinc.

4. Tin plating.Tin anode.

5. Nickel plating. 0,3-0,6 A/ dm_2, pH 5,6; 3 V, anode nickel.

6. Chromium plating. 10-20 A / dm_2, 35 -40 °C, anode lead.The compounds used for chromium plating are carcinogenic and dangerous for environment! Imitation of chrome plating, based on cobalt and zinc alloy can be used instead.

7. Silver plating.Anode stainless steel.

8.Silver plating. Anode stainless steel, 0,5 A/dm_2, 2-3 V, 20 °C, ammonia 1 cm3. Chemicals must be dissolved one by one(after previous compound is dissolved!) in boiling water,add silver chloride as last(fresh is the best: mix silver nitrate solution and kitchen salt solution).Must be boiled 30-180 minutes,filter when cold .Never try to mix solution and acids--deadly dangerous!

9.Gold plating. 4 V, 0,6 A/dm_2, 20 °C, anode stainless steel.Same process as 8.Never try to mix solution and acids -deadly dangerous!

10. Gold plating.Stainless steel anode.

ELECTROPLATING /II

INGREDIENTS,gms / lit.water	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Nickel sulphate	50									
Ammonium tartrate	36									
Silver chloride								40		
Platinum chloride		4								
Sodium phosphate		100								
Ammonium phosphate		20								
Basic copper carbonate							8			
Zinc oxide							8			
Potassium sodium tartarate					200		260			180
Sodium hydroxide							40			50
Potassium ferrocyanide								200	200	
Potassium carbonate								20	40	
Gold chloride									50	
Tin chloride			9,4							
Copper sulphate						30				35
Rhodium sulphate				2						
Iron II sulphate					40					
Sodium pyrophosphate			75							
Citric acid						20				
Glycol						48				

ADDITIONAL EXPLANATIONS: Electroplating/II

1. Nickel plating. Dissolve chemicals in the half liter of water,add 0,5 gm tannin,when it is dissolved add another half liter of water.pH 7.Nickel anode.

2.Platinum plating,for copper,silver and gold. Dissolve sodium phosphate,add ammonium phosphate,add platinum chloride.Anode platinum or stainless steel.

3.Pyrophosphate tin plating.Add 6,26 gm dextrine.Temp.60 C.

4.Rhodium plating. Rhodium sulphate 2-3 gm /metal content!/,sulphuric acid 40-60 gm. 1,5-2 A/dm2,temp.15-25 C.

5.Iron plating.Dissolve in 0,6 lit water,and then add 0.4 lit ammonia(25%).Iron anode.

6.Copper plating.Sulphate 15,6-31,2 gm,glycol 16-48 gm.Temp.18-25 C.Current density 0,5-1,5 A/dm2.

7.Brass plating. 0,5-0,7 A /dm2; 50 °C, pH 13,2-13,6. Anode brass!

3. 8.Silver plating.For copper an its alloys,tin,iron.Dissolve potassium ferrocyanide in the boiling water,add carbonate and when it is dissolved add silver chloride(fresh is the best).Boil 30-180 minutes.Filter when cooled.Anode stainless steel or fine silver.12 mll ammonia can be added too.Plated object must be then scratch brushed with fine brass wire brush, previously dipped in soapy water or stale beer.Can be used for electroforming too.Never try to mix solution and acids.Deadly dangerous!

9.Gold plating.For copper and its alloys,silver,tin,iron.Same process as 8. Anode stainless steel or platinum.Plated objects must be scratch brushed with fine brass wire brush, previously immersed in soapy water or stale beer.Can be used for electroforming too.Never try to mix solution and acids.Deadly dangerous!

10. Copper plating.Copper sulphate 35-40 gm,tartarate 180-190 gm,hydroxide 50-60 gm.Temp.20 C.Current density 0,3-1,5 A/dm2.

SHORT INSTRUCTIONS FOR SUCCESSFUL AND SAFE COLOURING AND PLATING OF METALS

1.EVERY METAL OBJECT CAN BE COLOURED OR PLATED ONLY IF IT IS PREVIOUSLY CLEANED FROM GREASE, OXIDE AND OTHER IMPURITIES (STANDARD WORKING CYCLE : DEGREASE+ PICKLE+ RINSE+ COLOUR OR PLATE+ RINSE+ DRY+ WAX OR LACQUER+ IN SOME CASES NEUTRALIZATION STEP CAN BE INCLUDED TOO!).FOR THE BEST RESULTS USE ONLY DISTILLED WATER!

2. IF TREATED METAL CANNOT BE COLOURED TO DESIRED COLOR WE MUST COVER THEM WITH METAL WHICH CAN BE COLOURED TO DESIRED COLOR.

3. OBJECTS CAN BE SPRAYED OR BRUSHED WITH SOLUTION OR IMMERSED IN SOLUTION FOR COLOURING. SAWDUST, PAPER OR TEXTILE CUTTINGS CAN BE MIXED WITH SOLUTION AND THEN APPLIED. THIS METHOD CANNOT BE USED WITH OXIDIZING COMPOUNDS BASED SOLUTIONS. IN SOME CASES COLOURING CAN BE SPEEDED WITH GAS TORCH OR HOT AIR GUN.

FINALLY OBJECTS CAN BE WAX OR LACQUER FINISHED.

4.SIMPLE CURRENT SOURCE FOR ELECTROPLATING IS A BATTERY. BEST CURRENT SOURCE IS PLATING RECTIFIER .AN OBJECT MUST BE CONNECTED TO THE NEGATIVE POLE AND ANODE TO THE POSITIVE POLE(EXCEPT IN THE CASE OF ANODIZING). WE CAN USE PLASTIC ,GLASS OR ENAMELLED IRON CONTAINERS.

5. ALL CHEMICALS USED IN COLOURING OR PLATING OF METALS ARE LESS OR MORE TOXIC ,SO WE MUST USE SAFETY GOGGLES, RUBBER GLOVES AND PROTECTIVE CLOTHING. IN SOME CASES WE MUST USE GAS MASK WITH APPROPRIATE FILTER. ALL FORMULAS BASED ON POTASSIUM OR SODIUM CYANIDE, ARSENE OR MERCURY COMPOUNDS ARE OMITTED! PROCESSES BASED

ON CHROMIUM, ANTIMONY, SELENIUM AND LEAD ARE INCLUDED BUT AUTHOR CANNOT RECOMMEND THEIR USE!

6. STRONG OXIDIZING COMPOUNDS USED IN SOME OF THE FORMULAS MUST BE HANLED WITH CAUTION BECAUSE OF THE FIRE HAZARD AND THEIR EXPLOSIVE NATURE. NEVER MIX THEM TOGETHER OR WITH ORGANIC MATERIALS OR SOLVENTS(POTASSIUM , SODIUM AND AMMONIUM NITRATE, CHLORATE , PERSULPHATE AND CHROMATE)!

7. ALL CHEMICALS MUST BE CLEARLY LABELED AND KEPT OUT OF REACH OF THE CHILDREN OR UNTRAINED PERSONS!

8.EXPIRED SOLUTIONS MUST BE DILUTED WITH AT LEAST 4 PARTS OF THE WATER TO THE ONE PART SOLUTION AND THEN NEUTRALIZED TO THE NEUTRAL PH. ONLY AFTER THAT STEP WE CAN THROW THEM AWAY. EXPIRED SOLUTIONS BASED ON COMPOUNDS OF CHROMIUM, LEAD ,ANTIMONY,COPPER, NICKEL, SELENIUM OR FERROCYANIDES MUST BE TREATED BY AUTHORIZED PERSONAL. BEFORE ANY FORM OF DISPOSAL, LOCAL LAW REGULATIONS MUST BE CONSULTED!

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RECOMMENDED WEBPAGES:

1.Finishing com -best forum dedicated to electroplating , colouring of metals and metal finishing

www.finishing.com/

2.Products Finishing Online -very good site too www.pfonline.com/

3.Internet archive - Excellent website,there you can find many 19th century electroplating and electroforming handbooks + 4 books on colouring of metals (Hiorns,Kaup,Field and Boney,Buchner) www.archive.org/

4.Download free book on metal colouring Chemische Faerbung von Kupfer und Kupferlegirungen,publisher is Deutsches Kupfer Institut(German Copper Institute)

www.kupferinstitut.de/front_frame/pdf/chemischeFaerbungen.pdf

5.Russian site dedicated to electroplating and metal finishing,here you can download many old ex USSR plating and finishing handbooks

www.galvanicrus.ru

6.United States Patent and Trademark Office there you can download hundreds of expired patents on electroplating,metal colouring,electroforming,corrosion inhibitors,anodizing,conversion coatings ,rust converters etc. www.uspto.gov

7.Patinas for copper,brass and bronze www.sciencecompany.com/patinas/

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