

GOVERNMENT OF INDIA, THE PATENT OFFICE
214, ACHARYA JAGADISH BOSE ROAD
CALCUTTA-700017.

Complete Specification No. *1585/5* dated 22nd December, 1980

Application and Provisional Specification No. 943/DEL/79 dated 24th December, 1979

Acceptance of the complete specification advertised on *1st July, 1984*

Index at acceptance— 70C₄ / LVIII(5) / 7

International Classification—C23b 5/00.

IMPROVED PROCESS FOR THE ELECTRO DEPOSITION OF NICKEL-
IRON ALLOY COATINGS ON METAL SUBSTRATES.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, Rafi Marg,
New Delhi-1, India, an Indian registered body incorporated
under the Registration of Societies Act (Act XXI of 1860).

The following specification describes the nature of this invention.

PRICE: TWO RUPEES

153515

This is an invention by Balraj Anantha Shenoi, Scientist; Mrs. Malathi Pushpavanan, Junior Technical Assistant and Mrs. Vidyalakshmi Raman, Junior Technical Assistant, all are Indian Nationals and are employed in the Central Electrochemical Research Institute, Karaikudi-623 006, India.

The invention relates to the improvements in or relating to the electro-deposition of Nickel-iron alloy deposit from sulfosalicylate baths.

Hitherto nickel has been used as one of the undercoats for decorative chromium deposits. In view of the scarcity and mounting cost of nickel, there is scope for replacing nickel undercoats by nickel-iron. The other baths known for nickel-iron plating give highly stressed deposits and large amount of stress relievers are to be used to get uniform and ductile deposits.

The object of this invention is to obviate these disadvantages by using iron-nickel alloy deposits in place of pure nickel and to improve the baths used for the above alloy deposition.

The main finding of the invention is the development of a new bath for the electrodeposition of iron-nickel alloy.

This new bath will give iron-nickel alloy containing varying amounts of iron-nickel-alloy without the cracking of the deposit. The deposit is smooth, semi-bright and ductile.

The present invention consists of a process for the electrodeposition of iron-nickel alloy from a bath containing nickel sulfosalicylate 180 g/l, iron sulfosalicylate 70 g/l, boric acid 30 g/l, having pH 2.8 - 3.5 at 55 - 65°C.

153515

EXAMPLE I

Nickel sulfosalicylate	180 g/l
Boric acid	30 g/l
Iron sulfosalicylate	70 g/l
pH	2.5 - 3.5
Temperature	55 - 65°C
Current density	3-5 A/dm ²
Agitation	Air agitation
Percentage of Iron in the deposit	30%
Nickel : Iron anode - ratio (by area)	1:1
Anode current density	2 - 3 A/dm ²
Substrate metal	Mild Steel for plating and platinum for analysis.

EXAMPLE II

Nickel	75 g/l
Sulfosalicylic acid	370 g/l
Ferrous Carbonate	30 g/l
Boric acid	40 g/l
Current density	4 - 5 A/dm ²
pH	2 - 3
Temperature	50 - 60°C
Agitation	No
Percentage of iron in the deposit	15%
Nickel : Iron anode ratio (by area)	2 : 1
Substrate	Mild steel for plating and platinum of analysis.

153515

EXAMPLE - III

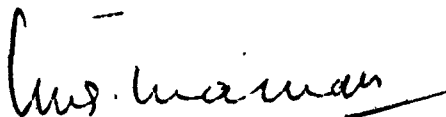
Nickel sulfosalicylate	150 g/l
Iron sulfosalicylate	80 g/l
Boric acid	40 g/l
Current density	3 - 4 A/dm ²
PH	3 - 3.5
Temperature	60 - 70°C
Agitation	air agitation near anode
Nickel : Iron anode ratio (by area)	1 : 1
Percentage iron in the deposit	25%
substrate	Mild Steel for plating and Platinum for analysis.

The following are the main advantages of this invention.

Semi bright, smooth deposits equivalent to pure nickel deposits are obtained. This can be used as a substrate substitute for pure matte nickel plating.

Iron-nickel deposits containing 10 - 35% iron can be obtained from a bath containing nickel sulfosalicylate 150 - 200 g/l. Iron sulfosalicylate 50 - 80 g/l boric acid 30 - 50 g/l using nickel and iron dual anode at the ratio in the range of 2:1 - 1:1 at 55 - 65°C, pH 2.8 - 3.5 at 3 - 7 A/dm² with or without air agitation.

Dated this 22nd day of December, 1979



(I.M.S.MAMAK)
PATENTS OFFICER

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

1 53515
THE PATENTS ACT. 1970

COMPLETE SPECIFICATION
(Section—10)

IMPROVED PROCESS FOR THE ELECTRO DEPOSITION OF NICKEL-
IRON ALLOY COATINGS ON METAL SUBSTRATES.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, Rafi Marg,
New Delhi-1, India, an Indian registered body incorporated
under the Registration of Societies Act (Act XXI of 1960)

The following specification particularly describes and ascertains the nature of this invention
and the manner in which it is to be performed :—

153515

This is an invention by Balkunje Anantha Shenoi, Scientist; Mrs. Malathy Pushpavanam, Junior Technical Assistant and Mrs. Vidyalakshmi Raman, Junior Technical Assistant, all are employed in the Central Electrochemical Research Institute, Karaikudi - 623 006, India - and all are Indian nationals.

This invention relates to an improved process for the electrodeposition of nickel-iron alloy coatings on metal substrates. The metal substrates used are of mild steel, copper or brass.

Hitherto nickel-iron alloy has been deposited from an electrolytic bath containing sulfate-chloride or sulfamate bath in the presence of additional components like trisodium citrate.

The object of this invention is to develop an improved electrolytic bath for nickel-iron alloy deposition of coatings wherein the stress in the alloy coatings obtained can be reduced without adding further additive to the bath as stress relievers.

The main finding of the invention is the development of the improved bath for nickel iron alloy deposition wherein we don't require any additional complexing agent and the internal stress of the alloy is also less.

Normally used process for obtaining nickel-iron alloy coatings by electrodeposition on the substrates comprises the steps of mechanically polishing the substrates, degreasing the same, alkaline cleaning and pickling followed by electroplating the substrate in a chemical electrolytic bath as stated above.

Nickel iron plating is finding application as a way of substituting the nickel. But the alloy has a slightly high internal stress for which a greater amount of stress relievers are added to minimise the stress. Moreover to keep the iron in solution, additional complexing agents are also added. By the development of this improved bath, we don't require any other complexant and we could get less stressed deposit with the same hardness value.

Semi bright, smooth deposits similar to nickel deposits are obtained in which the internal stress is slightly less than other sulfate chloride baths.

The process of the present invention consists in the electro deposition of nickel-iron alloy coatings on metal substrates from a bath containing salt of nickel, sulfosalicylic acid or nickel sulfosalicylate, iron sulfosalicylate, and boric acid at having pH of 2.8 - 3.5.

Iron nickel alloy deposits containing 10-35% iron can be obtained from a bath containing nickel sulfosalicylate 150-200 g/l iron sulfosalicylate 50-80 g/l, boric acid 30-50 g/l, using nickel and iron dual anode at the ratio of 2:1 - 1:1 at 55-65°C, pH 2.8 - 3.5 at 3-7 A/dm² with or without agitation.

Accordingly the invention provides an improved process for the electrodeposition of nickel-iron alloy coatings on metal substrates which comprises electrodepositing the substrates in an electrolytic bath consisting of sulfosalicylic acid salts of nickel and iron and boric acid maintained at pH of 2 to 3.5 and a temperature of 50 to 65°C.

According to a feature of the invention the electrolytic bath consists of nickel sulfosalicylate, iron sulfosalicylate and boric acid.

According to another feature of the invention the electrolytic bath consists of 180 g/l of nickel sulfosalicylate, 70 g/l of iron sulfosalicylate and 30 g/l of boric acid and the bath is maintained at a pH of 2.8 to 3.5 and a temperature of 55-65°C with an agitation.

According to a further feature of the invention the electrolytic bath consists of 200 g/l of nickel sulfosalicylate, 50 g/l of iron sulfosalicylate and 50 g/l of boric acid and the bath is maintained at a pH of 3.5 and a temperature of 65°C with-

-out agitation.

According to another further feature of the invention the electrodeposition is carried out at 3-5 A/dm² with nickel and iron anodes in the ratio of 2:1 to 1:1.

Thus the process for the electro deposition of nickel-iron alloy coatings on copper, brass or steel, substrates consists in using a bath containing nickel sulfosalicylate 180 g/l, iron sulfosalicylate 70 g/l, boric acid 30 g/l with nickel and iron anodes in the ratio of 1:1 at 60°C at pH 3 with air agitation wherein we get an alloy containing 30% iron.

The process for the electrodeposition of nickel iron alloy deposits on copper, brass or steel substrate preferably a bath containing nickel sulfosalicylate 180 g/l, iron sulfosalicylate 70 g/l, boric acid 30 g/l with nickel and iron anodes in the ratio of 1:1 at 60°C at pH 3 with or without agitation wherein we get alloy deposits having 15-30% iron.

The invention is further illustrated by the following examples:

Example 1

Nickel sulfosalicylate	:	180 g/l
Boric acid	:	30 g/l
Iron sulfosalicylate	:	70 g/l
pH	:	2.5 - 3.5
Temperature	:	55- 65°C.
Current density	:	3-5 A/dm ²
Agitation	:	By air
Percent iron in the alloy	:	30%
Nickel iron anode ratio(by area):	:	1:1
Anode current density	:	2-3 A/dm ²
Anode current density for nickel	:	1 - 1.5 A/dm ²
Anode current density for iron	:	1 - 1.5 A/Dm ²
Basis metal	:	Mild steel, copper or brass.
Cathodic efficiency	:	82%

1 5 3 5 1 5

Example 2

Nickel carbonate	:	75 g/l
Sulfosalicylic acid	:	370 g/l
Ferrous carbonate	:	30 g/l
Boric acid	:	40 g/l
Current density	:	4-5 A/dm ²
pH	:	2-3
Temperature	:	50-60 °C
Agitation	:	No
Percentage of iron in the alloy:		15%
Cathodic efficiency	:	92%
Nickel: iron anode ratio (by area)	:	2:1
Anode current density	:	2.5 - 3.5 A/dm ²
Anode current density for nickel:		1.6 - 2.3 A/dm ²
Anode current density for iron :		0.8 - 1.16 A/dm ²
Substrate	:	Mild steel, copper or brass.

Semi bright nickel-iron alloy coatings obtained contain 15-30% iron and have less stress value than the coatings obtained from other known baths.

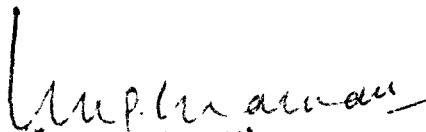
The bath used in the process of this invention has been thus modified by additive of sulfosalicylate so that semi bright and less stressed deposits could be obtained.

1 5 3 5 1 5

We Claim:

1. An improved process for the electrodeposition of nickel-iron alloy coatings on metal substrates comprising electroplating the substrates in an electrolytic bath consisting of sulfosalicylic acid salts of nickel and iron; and boric acid maintained at pH of 2 to 3.5 and a temperature of 50 to 65°C.
2. Process as claimed in claim 1 wherein the electrolytic bath consists of 180 g/l of nickel sulfosalicylate, 70 g/l of iron sulfosalicylate and 30 g/l of boric acid and the bath is maintained at a pH of 2.8 to 3.5 and a temperature of 55-60°C with an agitation.
3. Process as claimed in claim 1 ~~and~~ wherein the electrolytic bath consists of 200 g/l of nickel sulfosalicylate, 50 g/l of iron sulfosalicylate and 50 g/l of boric acid and the bath is maintained at a pH of 3.5 and a temperature of 65°C without agitation.
4. Process as claimed in any of the preceding claims wherein the electrodeposition is carried out at 3-5 A/dm² with nickel and iron anodes in the ratio of 2:1 to 1:1.
5. An improved process for the electrodeposition of nickel-iron alloys coating on metal substrates substantially as described and illustrated herein.

Dated this 20th day of December, 1980.



(I.M.S.MAMAK)

PATENTS OFFICER

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH.