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COBALT-NICKEL ALLOY PLATING BATHS

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This invention relates to plating baths for the preparation of magnetic cobalt-nickel alloys by electrolytic deposition.

An object of the present invention is the provision of a plating bath for the electrolytic deposition of cobalt-nickel alloys having high coercivity.

Another object of the invention is the provision of a plating bath for the electrolytic deposition of magnetic cobalt-nickel alloys in which the cobalt concentration can be controlled.

A further object of the invention is the provision of a plating bath for the electrolytic deposition of magnetic cobalt-nickel alloys having a high coercivity in which the cobalt concentration is controlled without causing a precipitate or changing the pH value of the bath.

The desirable results of the invention are obtained by adding specified amounts of pyridine, a carbon-hydrogen-nitrogen compound (C_5H_5N), to a plating bath comprising nickel chloride and cobalt chloride in solution. The plating voltage used is extremely critical and must be controlled closely over a narrow range. The alloys produced by this process are useful in forming magnetic recording surfaces for information storage.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention.

A plating bath constituted in accordance with the present invention has its composition given in Table 1 below.

TABLE I

Constituent:	Concentration
$CoCl_2 \cdot 6H_2O$	20 g./l.
$NiCl_2 \cdot 6H_2O$	31.3 g./l.
Pyridine	.0003 M to .003 M.
pH=6.0.	

The plating bath is formed by merely dissolving the cobalt chloride and nickel chloride in water. The desired amount of pyridine is then added, and the slightly acidic solution is diluted to attain the desired volume concentration. The pH is adjusted to 6.0 using conventional methods. The cobalt chloride serves as a source of cobalt ions, and the nickel chloride serves as a source of nickel ions. The sulfates of cobalt and nickel could be substituted for the chlorides provided that the amounts of cobalt and nickel ions remain the same.

The presence of pyridine in the plating bath produces a distinctive result in accordance with the invention. The pyridine reacts with the cobalt and nickel ions in the bath to form complexes which affect the amount of each metal deposited. The formation of these complexes causes a lowering of the voltage required to deposit the ions of both metals.

The deposition of nickel from the nickel complex

proceeds in straightforward fashion. The deposition of the cobalt ions, however, involves a cyclic reaction in which a large catalytic current occurs. This catalytic current causes a decrease in the amount of cobalt plated out of the solution. The magnitude of the catalytic current and, therefore, the amount of cobalt deposited into the plated film is controlled by the amount of pyridine present in the plating bath. Thus, the composition of the plated films may be controlled by controlling the amount of pyridine in the plating bath. Table 2 below shows the effect of the pyridine concentration on the coercivity and the percentage composition of the cobalt in the plated film.

TABLE 2

Pyridine Molal Concentration	Coercive Force	Percent Co in film
0	242	73
.0003	273	65
.001	332	63
.002	270	59
.003	200	59

The plating voltage used in the reaction is extremely critical and must be controlled closely over a narrow range. When a saturated calomel electrode is utilized as a reference electrode, the cathode-to-reference potential difference may vary from —0.80 volt to —1.30 volts with satisfactory results. A cathode-to-reference potential difference of —1.05 volts is preferred.

The data in Table 2 were tabulated from results obtained with films plated on copper-clad substrates cleaned in dilute hydrochloric acid. The plating bath was constituted as set forth in Table 1, and the cathode-to-reference potential difference was —1.05 volts.

While the invention has been shown and described with particular reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and details may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. An aqueous acidic plating bath for the preparation of magnetic cobalt-nickel alloys by electrolytic deposition comprising a solution of cobalt chloride and nickel chloride to which pyridine has been added.

2. An aqueous plating bath for the preparation of magnetic cobalt-nickel alloys by electrolytic deposition comprising a solution of cobalt chloride and nickel chloride to which pyridine has been added, the pH of the solution being approximately 6.

3. An aqueous acidic plating bath for the preparation of magnetic cobalt-nickel alloys by electrolytic deposition comprising a solution of cobalt chloride and nickel chloride to which pyridine has been added in a concentration of 0.0003 M to 0.003 M.

4. An aqueous plating bath for the preparation of magnetic cobalt-nickel alloys by electrolytic deposition comprising a solution of cobalt chloride and nickel chloride to which pyridine has been added in a concentration of 0.0003 M to 0.003 M, the pH of the solution being approximately 6.

5. An aqueous plating bath for the preparation of magnetic cobalt-nickel alloys by electrolytic deposition comprising a solution of $CoCl_2 \cdot 6H_2O$ in a concentration of

approximately 20 grams per liter and $NiCl_2 \cdot 6H_2O$ in a concentration of approximately 30 grams per liter to which pyridine has been added in a concentration of 0.0003 M to 0.003 M, the pH of the solution being approximately 6.

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