nickel film of which the film thickness is 0.1 to 15 μm, the palladium film of which the film thickness is 0.001 to 2 μm, and the gold film of which the film thickness is 0.001 to 1 μm are formed, on a surface of a copper material by the above described electroless plating process.

[0007]

In order to achieve further high density mounting of electronic parts in the Ni/Au film or the Ni/Pd/Au film, it is desired to further thin the nickel film.

[Citation List]

[Patent Literature]

[0008]

[Patent Literature 1] Japanese Patent Laid-Open No. 2008-174774

[Summary]

[Technical Problem]

[0009]

However, when an extremely thin nickel film of which the film thickness is, for example, 0.01 μm or less is formed with the use of the above described electroless nickel plating solution, there is a case where the covering becomes insufficient and a non-deposition superfine area (hole) is formed on the surface of the nickel film. Then, when the subsequent electroless gold

plating (S17) has been performed, there is a case where the non-deposition superfine area is corroded and a through hole is formed which penetrates through the nickel film (nickel local corrosion phenomenon). In that case, there is a disadvantage in the Ni/Au film or the Ni/Pd/Au film that excellent mounting characteristics cannot be obtained.

[0010]

An object of the present disclosure is to provide an electroless nickel plating solution that can form a nickel film which can surely cover a surface of a copper material even when the film thickness is thin, and a method for forming a nickel film using the electroless nickel plating solution.

[Solution to Problem]

[0011]

An electroless nickel strike plating solution according to the present disclosure is an electroless nickel strike plating solution used for forming a nickel film on a surface of a copper material, and includes a water-soluble nickel salt in a concentration of 0.002 to 1 g/L in terms of nickel, one or more carboxylic acids or salts thereof, and one or more reducing agents selected from the group of dimethylamine borane, trimethylamine borane, hydrazine and a hydrazine derivative.

[0011a]

In one aspect, the present disclosure refers to an electroless nickel strike plating solution used for forming a nickel film on a surface of a copper material, comprising: a water-soluble nickel salt in a concentration of 0.002 to 1 g/L in terms of nickel; one or more carboxylic acids or salts thereof; and one or more reducing agents selected from the group of dimethylamine borane, trimethylamine borane, hydrazine and a hydrazine derivative.

[0012]

In the electroless nickel strike plating solution according to the present disclosure, it is preferable that the carboxylic acid is one or more selected from the group consisting of a monocarboxylic acid, a dicarboxylic acid, a tricarboxylic acid, a hydroxydicarboxylic acid, a hydroxytricarboxylic acid, an aromatic carboxylic acid, an oxocarboxylic acid and an amino acid.

[0013]

In the electroless nickel strike plating solution according to the present disclosure, it is preferable that the monocarboxylic acid is one or more selected from the group of formic acid, acetic acid, propionic acid, gluconic acid and butyric acid.

[0014]

In the electroless nickel strike plating solution according to the present disclosure, it is preferable that the dicarboxylic acid is one or more selected from the group of oxalic acid, malonic acid, succinic acid, adipic acid, fumaric acid and maleic acid.

[0015]

In the electroless nickel strike plating solution according to the present disclosure, it is preferable that the tricarboxylic acid is aconitic acid.

[0016]

In the electroless nickel strike plating solution according to the present disclosure, it is preferable that

the hydroxydicarboxylic acid is malic acid.

[0017]

In the electroless nickel strike plating solution according to the present disclosure, it is preferable that the hydroxytricarboxylic acid is citric acid.

[0018]

In the electroless nickel strike plating solution according to the present disclosure, it is preferable that the aromatic carboxylic acid is one or more selected from the group of benzoic acid, phthalic acid and salicylic acid.

[0019]

In the electroless nickel strike plating solution according to the present disclosure, it is preferable that the oxocarboxylic acid is pyruvic acid.

[0020]

In the electroless nickel strike plating solution according to the present disclosure, it is preferable that the amino acid is one or more selected from the group of arginine, asparagine, aspartic acid, cysteine, glutamic acid and glycine.

[0021]

It is preferable that the electroless nickel strike plating solution according to the present disclosure is prepared by mixing and stirring the water-soluble nickel salt, the carboxylic acid or the salt thereof and water

to prepare an aqueous solution containing a nickel complex, then mixing the reducing agent into the aqueous solution, and stirring the mixture.

[0022]

A method for forming a nickel film according to the present disclosure is a method for forming a nickel film on a surface of a copper material, and includes forming a nickel film on a surface of a copper material by an electroless strike plating method using the electroless nickel strike plating solution.

[0022a]

In one aspect, the present disclosure refers to a method for forming a nickel film on a surface of a copper material, comprising forming a nickel film on a surface of a copper material by an electroless strike plating method using the electroless nickel strike plating solution disclosed herein.

[0023]

In the method for forming a nickel film according to the present disclosure, it is preferable that a pH of the electroless nickel strike plating solution is adjusted to 6 to 10 and a bath temperature thereof is adjusted to 20 to 55°C.

[0024]

It is preferable that the method for forming a nickel film according to the present disclosure

forms a nickel film of which a film thickness is 0.005 to 0.3 μm.

[Advantageous Effect of Disclosure]

[0025]

According to the electroless nickel strike plating solution and the method for forming a nickel film according to the present disclosure, it is possible to obtain a nickel film which can surely cover the surface

Claims

[Claim 1]

An electroless nickel strike plating solution used for forming a nickel film on a surface of a copper material, comprising:

a water-soluble nickel salt in a concentration of 0.002 to 1 g/L in terms of nickel;

one or more carboxylic acids or salts thereof; and

one or more reducing agents selected from the group of dimethylamine borane, trimethylamine borane, hydrazine and a hydrazine derivative.

[Claim 2]

The electroless nickel strike plating solution according to claim 1, wherein the carboxylic acid is one or more selected from the group consisting of a monocarboxylic acid, a dicarboxylic acid, a tricarboxylic acid, a hydroxydicarboxylic acid, a hydroxytricarboxylic acid, an aromatic carboxylic acid, an oxocarboxylic acid and an amino acid.

[Claim 3]

The electroless nickel strike plating solution according to claim 2, wherein the monocarboxylic acid is one or more selected from the group of formic acid, acetic acid, propionic acid, gluconic acid and butyric acid.

[Claim 4]

The electroless nickel strike plating solution according to claim 2, wherein the dicarboxylic acid is one or more selected from the group of oxalic acid, malonic acid, succinic acid, adipic acid, fumaric acid and maleic acid.

[Claim 5]

The electroless nickel strike plating solution according to claim 2, wherein the tricarboxylic acid is aconitic acid.

[Claim 6]

The electroless nickel strike plating solution according to claim 2, wherein the hydroxydicarboxylic acid is malic acid.

[Claim 7]

The electroless nickel strike plating solution according to claim 2, wherein the hydroxytricarboxylic acid is citric acid.

[Claim 8]

The electroless nickel strike plating solution according to claim 2, wherein the aromatic carboxylic acid is one or more selected from the group of benzoic acid, phthalic acid and salicylic acid.

[Claim 9]

The electroless nickel strike plating solution according to claim 2, wherein the oxocarboxylic acid is pyruvic acid.

[Claim 10]

The electroless nickel strike plating solution according to claim 2, wherein the amino acid is one or more selected from the group of arginine, asparagine, aspartic acid, cysteine, glutamic acid and glycine.

[Claim 11]

The electroless nickel strike plating solution according to any one of claims 1 to 10, wherein the electroless nickel strike plating solution is prepared by mixing and stirring the water-soluble nickel salt, the carboxylic acid or a salt thereof and water to prepare an aqueous solution containing a nickel complex, then mixing the reducing agent into the aqueous solution, and stirring the mixture.

[Claim 12]

A method for forming a nickel film on a surface of a copper material, comprising

forming a nickel film on a surface of a copper material by an electroless strike plating method using the electroless nickel strike plating solution according to any one of claims 1 to 11.

[Claim 13]

The method for forming a nickel film according to claim 12, wherein a pH of the electroless nickel strike plating solution is adjusted to 6 to 10, and a bath temperature thereof is adjusted to 20 to 55°C.

[Claim 14]

The method for forming a nickel film according to claim 12 or 13, wherein a nickel film of which a film thickness is 0.005 to 0.3 μm is formed.

[Claim 15]

The electroless nickel strike plating solution according to claim 1, wherein the carboxylic acid is lactic acid.