Claims

1. An aqueous electroplating solution for alkaline electroplating, comprising:

$[Pt(NH_3)_4]^{2+}$ ions; and organic anions selected from the group consisting of bicarbonate, carbonate, or a mixture thereof;

wherein the molar ratio of Pt : (bicarbonate + carbonate) is from 1 : 1 to 1 : 10; and

wherein the following species, if present, are present in the following amounts:
alkali metals in an amount of less than 5 g/L;
compounds comprising phosphorus in an amount of less than 5 g/L;
compounds comprising boron in an amount of less than 5 g/L.

2. An aqueous electroplating solution according to claim 1, wherein the molar ratio of Pt : (bicarbonate + carbonate) is from 1 : 1 to 1 : 5.

3. An aqueous electroplating solution according to claim 1, wherein the molar ratio of Pt : (bicarbonate + carbonate) is approximately 1 : 2.

4. An aqueous electroplating solution according to claim 1, wherein the molar ratio of Pt : (bicarbonate + carbonate) is approximately 1 : 1.

5. An aqueous electroplating solution according to any one of claims 1 to 4, wherein the concentration of Pt in the solution is 1 to 30 g/litre, on a metal basis.

6. An aqueous electroplating solution according to any one of claims 1 to 5, wherein the pH of the solution is 8 to 14.

7. An aqueous electroplating solution according to any one of claims 1 to 6, comprising a pH adjusting agent selected from the group consisting of ammonia, urea, an alkylammonium hydroxide, ammonium hydroxide, ammonium bicarbonate and ammonium carbonate.

8. An aqueous electroplating solution according to any one of claims 1 to 7, wherein the content of alkali metals is less than 0.1 g/L.

9. An aqueous electroplating solution according to any one of claims 1 to 8, wherein the content of halide ions in the electroplating solution is less than 1 g/L.

10. An aqueous electroplating solution according to any one of claims 1 to 9, wherein the content of nitrite ions in the electroplating solution is less than 0.5 g/L.

11. An aqueous electroplating solution according to any one of claims 1 to 10, wherein the content of nitrate ions in the electroplating solution is less than 0.5 g/L.

12. An aqueous electroplating solution according to any one of claims 1 to 11, wherein the content of compounds containing silicon is less than 0.5 g/L.

13. An aqueous electroplating solution according to any one of claims 1 to 12, wherein the content of compounds containing sulfur is less than 0.5 g/L.

14. An electroplating bath comprising a cathode and an anode which are both at least partially submerged in an electrolyte, wherein the electrolyte is an aqueous electroplating solution according to any of claims 1 to 13.

15. A method of forming a metal layer on a substrate by electroplating, wherein electroplating is carried out using a bath comprising a cathode and an anode which are both at least partially submerged in an electrolyte, wherein the electrolyte is an aqueous electroplating solution according to any of claims 1 to 13.

16. A method as claimed in claim 15, wherein electroplating is carried out at a temperature of 80 °C or more.

17. A method as claimed in claim 15, wherein electroplating is carried out at a temperature of 60 to 100 °C or more and a pH of 8 to 14.

18. A method as claimed in any of claims 15 to 17, wherein the bath is replenished with fresh electroplating solution as required.

19. A method as claimed in any of claims 15 to 18, wherein a pH adjusting agent is added to the bath as required.

20. A method as claimed in any of claims 15 to 19, wherein the cathode provides the substrate to be coated.

21. A method as claimed in any of claims 15 to 20, comprising a step of pausing electroplating and increasing the temperature of the electrolyte in order to purge the bath of residual organic anion.

22. A method as claimed in any of claims 15 to 21, wherein the cathode acts as the substrate and is selected from jewellery, a medical component or an aviation component.