Claim 1. A method of creating copper strip comprising the steps of:

a. providing copper alloy strip to be processed to a predetermined thickness and with a predetermined anti-microbial characteristic;

b. the copper alloy strip is annealed;

c. the copper alloy strip is cleaned to remove oxides prior to final rolling;

d. the copper alloy strip is loaded, in coil form, into a rolling mill and rolled to a predetermined thickness;

e. the copper alloy strip has a surface roughness between 2 to 50 micro inches, a more precise range of surface roughness is determined at least in part in reliance upon said predetermined anti-microbial characteristic;

f. the copper alloy strip, in coil form, is loaded into a cleaning line which is at least semi-continuous, to remove any residual rolling lubricants;

g. a degreasing solution is used to remove such lubricants;

h. the copper alloy strip is rinsed with water and dried;

i. the copper alloy strip is formed back into a coil; and

j. the copper alloy strip is slit to form predetermined widths and packaged for shipment without any coating disposed thereon which isolates a side of said copper alloy strip from atmospheric oxygen.

Claim 2. A method of claim 1 wherein said surface roughness is between 4 and 36 micro inches.

Claim 3. A method of claims 1 or 2 wherein said surface roughness is between 6 and 14 micro inches Ra.

Claim 4. A method of claims 1-3 wherein said copper alloy strip is treated with an acid configured to dissolve metal oxides.

Claim 5. A method of claims 1-4 wherein said acid is sulfuric acid of less than 30% concentration.

Claim 6. A method of claims 1-5 wherein said sulfuric acid is combined with an oxidizing agent.

Claim 7. A method of claims 1-6 wherein said oxidizing agent is hydrogen peroxide.

Claim 8. A method of claims 1-7 wherein said sulfuric acid is between 10% to 20% concentration and the hydrogen peroxide is in a concentration of 0.5 to 3%.

Claim 9. The method of claims 1-8 wherein said copper alloy strip is dried with an application of a heated blown drying air.

Claim 10. A method of providing a solution with continuously replenishing copper dissolved therein, the method comprising the steps of:

a. providing a mass of solid copper alloy having a copper alloy contact surface; wherein the copper alloy contact surface has a predetermined surface roughness characteristic and an associated predetermined characteristic for killing microbes;

b. said copper alloy contact surface being free of any barrier coating thereon which covers said copper alloy contact surface, isolates said copper alloy contact

surface from exposure to atmospheric oxygen and further provides said copper alloy contact surface with an increased wetting angle;

c. said copper alloy contact surface being a surface configured to provide a continuous source of copper;

d. directing placement of said mass of solid copper alloy by advising users that deploying said mass of copper alloy with said copper alloy contact surface with and because of said predetermined characteristic for killing microbes into an application configured to facilitate exposure to contact with a human hand or contaminated particles provides for a reduction in live harmful pathogens disposed on said copper alloy contact surface.

Claim 11. The method of claim 10 wherein said step of directing placement comprises the steps of:

manufacturing a useful object from said mass of solid copper alloy and advising users that said useful object has anti-microbial properties.

Claim 12. The method of claims 10 or 11 wherein said useful object is a coin minted by a government and released for distribution.

Claim 13. A method of designing and manufacturing a useful article with an anti-microbial characteristic comprising the steps of:

determining that an anti-microbial characteristic is a minimum design requirement of a useful article;

determining a surface roughness characteristic of a contact surface on the useful article based at least in part upon a minimum requirement for an anti-microbial characteristic;

providing a copper alloy contact surface configured substantially to conform with said surface roughness characteristic so as to continuously provide a source of copper to be dissolved in high concentrations into a solution disposed on the copper alloy contact surface.

Claim 14. A method of reducing transmission of disease comprising the steps of:

providing a copper alloy surface on a door at a location that is designed to be contacted by a human hand when the door is being opened;

said copper alloy surface having a surface roughness of 6 to 14 micro inches Ra and being free of any coating thereon which tends to increase a wetting angle of the copper alloy surface; and

deploying the door in a hospital.

Claim 15. The method of claims 1-14 where the copper alloy has a contact angle of less than about 75° as measured by Method A.

Claim 16. The method of claims 1-14 where the copper alloy has a contact angle of less than about 50° as measured by Method A.

Claim 17. The method of claims 1-14 where the copper alloy has a contact angle of less than about 25° as measured by Method A.

Claim 18. The method of claims 1-17 wherein the copper alloy has a 3log10 reduction in colony forming units in less than about 60 minutes as measured by Method B.

Claim 19. The method of claims 1-17 wherein the copper alloy has a 3log10 reduction in colony forming units in less than about 45 minutes as measured by Method B.

Claim 20. The method of claims 1-17 wherein the copper alloy has a 3log10 reduction in colony forming units in less than about 30 minutes as measured by Method B.

CLAIMS

1. A method of reducing active microorganisms comprising:

providing a copper alloy comprising a contact surface which provides copper ions or produces a copper oxide, or both, said contact surface having a roughness of between about 6 and about 14 microinches Ra; and

exposing said contact surface to an active microorganism;

wherein the contact surface is not coated with a polymer finish, barrier coating, tarnish inhibitor, oil, grease, or wax; and

wherein the contact surface has a lower contact angle, a higher rate of copper evolution into aqueous solution, and a higher rate of microbial inactivation, as compared to a copper alloy contact surface coated with benzotriazole.

2. The method of claim 1, wherein the surface roughness is about 10 microinches Ra.

3. The method of claim 1, wherein the copper alloy is copper.

4. The method of claim 1, wherein the copper alloy is copper alloy C110.

5. The method of claim 1, wherein the aqueous solution is an artificial sweat formulation.

6. The method of claim 1, wherein the higher rate of copper evolution into aqueous solution is at least 10 times higher.

7. The method of claim 6 wherein the higher rate of copper evolution into aqueous solution is at least 30 times higher.

8. The method of claim 1, wherein the contact surface is chemically etched.

9. The method of claim 1, wherein the microorganism is *E. coli*.

10. The method of claim 9, wherein the higher rate of microbial inactivation comprises a reduction in *E. coli* by at least 99% within about 60 minutes.

11. The method of claim 10, wherein the higher rate of microbial inactivation comprises a reduction in *E. coli* by at least 99% within about 45 minutes.

12. The method of claim 11, wherein the higher rate of microbial inactivation comprises a reduction in *E. coli* by at least 99% within about 30 minutes.

13. The method of any one of claims 1, 2, 9, or 10, wherein a hospital touch surface or lighting device or control comprising said copper alloy is provided.

14. A method of reducing active microorganisms comprising:

providing a copper alloy comprising a contact surface which provides copper ions or produces a copper oxide, or both, said contact surface having a roughness of between about 6 and about 14 microinches Ra; and

exposing said contact surface to an active microorganism;

wherein the contact surface is not coated with a polymer finish, barrier coating, tarnish inhibitor, oil, grease, or wax; and

wherein the contact surface has a higher rate of copper evolution into aqueous solution as compared to a copper alloy contact surface coated with benzotriazole.

15. The method of claim 14, wherein the surface roughness is about 10 microinches Ra.

16. The method of claim 14, wherein the copper alloy is copper.

17. The method of claim 14, wherein the copper alloy is copper alloy C110.

18. The method of claim 14, wherein the aqueous solution is an artificial sweat formulation.

19. The method of claim 14, wherein the microorganism is *E. coli*.

20. The method of claim 14, wherein the higher rate of copper evolution into aqueous solution is at least 10 times higher.

21. The method of claim 20, wherein the higher rate of copper evolution into aqueous solution is at least 30 times higher.

22. The method of any one of claims 14, 15, 19, and 20, wherein a hospital touch surface or lighting device or control comprising said copper alloy is provided.

23. A method of reducing active microorganisms comprising:

providing a copper alloy comprising a contact surface which provides copper ions or produces a copper oxide, or both, said contact surface having a roughness of between about 6 and about 14 microinches Ra; and

exposing said contact surface to an active microorganism;

wherein the contact surface is not coated with a polymer finish, barrier coating, tarnish inhibitor, oil, grease, or wax; and

wherein the contact surface has a higher rate of microbial inactivation as compared to a copper alloy contact surface coated with benzotriazole.

24. The method of claim 23, wherein the surface roughness is about 10 microinches Ra.

25. The method of claim 23, wherein the copper alloy is copper.

26. The method of claim 23, wherein the copper alloy is copper alloy C110.

27. The method of claim 23, wherein the microorganism is *E. coli.*

28. The method of claim 27, wherein the higher rate of microbial inactivation comprises a reduction in *E. coli* by at least 99% within about 60 minutes.

29. The method of claim 28, wherein the higher rate of microbial inactivation comprises a reduction in *E. coli* by at least 99% within about 45 minutes.

30. The method of claim 29, wherein the higher rate of microbial inactivation comprises a reduction in *E. coli* by at least 99% within about 30 minutes.

31. The method of claim 23, wherein the higher rate of microbial inactivation comprises a 3 $\log_{10}$ reduction in CFU that is at least about 40% to about 60% faster as compared to the copper alloy contact surface coated with benzotriazole.

32. The method of any one of claims 23, 24, 27, and 28, wherein a hospital touch surface or lighting device or control comprising said copper alloy is provided.

33. A method of reducing active microorganisms comprising:

providing a touch surface comprising a copper alloy which provides copper ions or produces a copper oxide, or both, said contact surface having a roughness of between about 6 and about 14 microinches Ra; and

exposing said touch surface to an active microorganism;

wherein the touch surface is not coated with a polymer finish, barrier coating, tarnish inhibitor, oil, grease, or wax; and

wherein the touch surface has a lower contact angle, a rate of copper evolution into aqueous solution that is at least 15 to 25 times higher, and a rate of microbial inactivation comprising a 3 $\log_{10}$ reduction in CFU that is at least about 40% to about 60% faster, as compared to a copper alloy contact surface coated with benzotriazole.

34. The method of claim 33, wherein the touch surface is a hospital touch surface.

35. A product comprising:

a copper alloy comprising a contact surface which provides copper ions or produces a copper oxide, or both, said contact surface having a roughness of between about 6 and about 14 microinches Ra;

wherein the contact surface is not coated with a polymer finish, barrier coating, tarnish inhibitor, oil, grease, or wax; and

wherein the contact surface has a lower contact angle, a higher rate of copper evolution into aqueous solution, and a higher rate of microbial inactivation, as compared to a copper alloy contact surface coated with benzotriazole.

36. The product of claim 35 wherein the surface roughness is about 10 microinches Ra.

37. The product of claim 35 wherein the copper alloy is copper.

38. The product of claim 35 wherein the copper alloy is copper alloy C110.

39. The product of claim 35 wherein the aqueous solution is an artificial sweat formulation.

40. The product of claim 35 wherein the higher rate of copper evolution into aqueous solution is at least 10 times higher.

41. The product of claim 40 wherein the higher rate of copper evolution into aqueous solution is at least 30 times higher.

42. The product of claim 35 wherein the contact surface is chemically etched.

43. The product of claim 35, wherein the higher rate of microbial inactivation comprises a reduction in *E. coli* by at least 99% within about 60 minutes.

44. The product of claim 43 wherein the higher rate of microbial inactivation comprises a reduction in *E. coli* by at least 99% within about 45 minutes.

45. The product of claim 44, wherein the higher rate of microbial inactivation comprises a reduction in *E. coli* by at least 99% within about 30 minutes.

46. The product of any of claims 35, 36, 39, 40, and 43, wherein said product is a rolled strip, hospital touch surface, or lighting device or control.

47. A product comprising:

a copper alloy comprising a contact surface which provides copper ions or produces a copper oxide, or both, said contact surface having a roughness of between about 6 and about 14 microinches Ra;

wherein the contact surface is not coated with a polymer finish, barrier coating, tarnish inhibitor, oil, grease, or wax; and

wherein the contact surface has a higher rate of copper evolution into aqueous solution as compared to a copper alloy contact surface coated with benzotriazole.

48. The product of claim 47 wherein the surface roughness is about 10 microinches Ra.

49. The product of claim 47 wherein the copper alloy is copper.

50. The product of claim 47 wherein the copper alloy is copper alloy C110.

51. The product of claim 47 wherein the aqueous solution is an artificial sweat formulation.

52. The product of claim 47 wherein the higher rate of copper evolution into aqueous solution is at least 10 times higher.

53. The product of claim 52 wherein the higher rate of copper evolution into aqueous solution is at least 30 times higher.

54. The product of any of claims 47, 48, 51, and 52, wherein said product is a rolled strip, hospital touch surface, or lighting device or control.

55. A product comprising:

a copper alloy comprising a contact surface which provides copper ions or produces a copper oxide, or both, said contact surface having a roughness of between about 6 and about 14 microinches Ra;

wherein the contact surface is not coated with a polymer finish, barrier coating, tarnish inhibitor, oil, grease, or wax; and

wherein the contact surface has a higher rate of microbial inactivation as compared to a copper alloy contact surface coated with benzotriazole.

56. The product of claim 55 wherein the surface roughness is about 10 microinches Ra.

57. The product of claim 55 wherein the copper alloy is copper.

58. The product of claim 55 wherein the copper alloy is copper alloy C110.

59. The product of claim 55, wherein the higher rate of microbial inactivation comprises a reduction in *E. coli* by at least 99% within about 60 minutes.

60. The product of claim 59 wherein the higher rate of microbial inactivation comprises a reduction in *E. coli* by at least 99% within about 45 minutes.

61. The product of claim 60, wherein the higher rate of microbial inactivation comprises a reduction in *E. coli* by at least 99% within about 30 minutes.

62. The product of claim 55, wherein the higher rate of microbial inactivation comprises a 3 $\log_{10}$ reduction in CFU that is at least about 40% to about 60% faster as compared to the copper alloy contact surface coated with benzotriazole.

63. The product of any one of claims 55, 56, 59, and 62, wherein said product is a rolled strip, hospital touch surface, or lighting device or control.

64. A product comprising:

a touch surface comprising a copper alloy which provides copper ions or produces a copper oxide, or both, said touch surface having a roughness of between about 6 and about 14 microinches Ra;

wherein the touch surface is not coated with a polymer finish, barrier coating, tarnish inhibitor, oil, grease, or wax; and

wherein the touch surface has a lower contact angle, a rate of copper evolution into aqueous solution that is at least 15 to 25 times higher, and a rate of microbial inactivation comprising a 3 $\log_{10}$ reduction in CFU that is at least about 40% to about 60% faster, as compared to a copper alloy contact surface coated with benzotriazole.

65. The product of claim 64, wherein the touch surface is a hospital touch surface.

66. A product comprising:

a rolled strip comprising a copper alloy, said copper alloy comprising a contact surface which provides copper ions or produces a copper oxide, or both, and said contact surface having a roughness of between about 6 and about 14 microinches Ra;

wherein the contact surface is not coated with a polymer finish, barrier coating, tarnish inhibitor, oil, grease, or wax; and

wherein the contact surface has a lower contact angle, a rate of copper evolution into aqueous solution that is at least 15 to 25 times higher, and a rate of microbial inactivation comprising a 3 $\log_{10}$ reduction in CFU that is at least about 40% to about 60% faster, as compared to a copper alloy contact surface coated with benzotriazole.

67. A method of making a copper alloy product comprising:

a.) providing a copper alloy comprising at least one surface;

b.) processing the surface to a roughness of between about 6 and about 14 microinches Ra;

c.) degreasing the surface; and

d.) drying the surface;

wherein said method does not include coating the surface with a polymer finish, barrier coating, tarnish inhibitor, oil, or wax.

68. The method of claim 67, wherein the roughness is about 10 microinches Ra.

69. The method of claim 67, wherein the copper alloy is copper.

70. The method of claim 67, wherein the copper alloy is copper alloy C110.

71. The method of claim 67, wherein the processing of the surface is performed by chemical etching.

72. The method of claim 67, further comprising treating the surface with an acid or oxidizing agent, or both.

73. The method of claim 72, wherein the surface is treated with sulfuric acid.

74. The method of claim 73, wherein the surface is treated with hydrogen peroxide.

75. The method of claim 74, wherein the sulfuric acid is an amount of about 10 to about 20% and the hydrogen peroxide is in an amount of about 1 to about 3%.

76. The method of claim 67, where said drying is by forced air drying.

77. The method of claim 67, wherein the surface is heated subsequent to said drying.

78. The method of claim 77, wherein the heating is by furnace treatment.

79. The method of claim 78, wherein the furnace treatment is for a period of about 5 minutes to about 2 hours.

80. The method of claim 78, wherein the furnace treatment is at a temperature of between about 200°C and about 400°C in air.

81. The method of claim 78, wherein the furnace treatment is for a period of about 5 minutes and at a temperature of about 400°C in air.

82. The method of claim 78, wherein the furnace treatment is for a period of about 2 hours and at a temperature of about 200°C in air.

83. A copper alloy product produced by the method of claim 67, wherein the surface is a contact surface having a lower contact angle as compared to a copper alloy contact surface coated with benzotriazole.

84. A copper alloy product produced by the method of claim 67, wherein the surface is a contact surface having a higher rate of copper evolution into aqueous solution as compared to a copper alloy contact surface coated with benzotriazole.

85. A copper alloy product produced by the method of claim 67, wherein the surface is a contact surface having a higher rate of microbial inactivation as compared to a copper alloy contact surface coated with benzotriazole.

86. The method of any one of claims 67, 68, 72, 80, 83, 84, and 85, wherein the copper alloy product is a rolled strip, hospital touch surface, or lighting device or control.

87. The method of claim 86, wherein the copper alloy product is a rolled strip.

88. A method of making a copper alloy product comprising:

a.) providing a copper alloy comprising at least one surface;

b.) processing the surface to a roughness of between about 6 and about 14 microinches Ra;

c.) degreasing the surface;

d.) treating the surface with sulfuric acid and hydrogen peroxide;

e.) drying the surface by forced air drying; and

f.) furnace treating the surface for a period of about 5 minutes and at a temperature of about 400°C in air;

wherein said method does not include coating the surface with a polymer finish, barrier coating, tarnish inhibitor, oil, or wax; and

wherein the copper alloy product is a rolled strip.

89. The method of claim 88, wherein the roughness is about 10 microinches Ra.

90. The method of claim 88, wherein the sulfuric acid is an amount of about 10 to about 20% and the hydrogen peroxide is in an amount of about 1 to about 3%.

91. The product produced by the method of any one of claims 67-82 and 86-90.