What is claimed is:

1. An electroplating composition comprising: a bath-soluble source of silver ions; water; acid electrolyte; and a sulfide compound of the formula:

$$Y^1\text{-}(CR^1R^2)_m\text{-}S\text{-}(CR^3R^4)_x\text{-}S\text{-}(CR^5R^6)_n\text{-}Y^2$$

wherein Y^1 and Y^2 are independently chosen from CO_2H, SO_3H, PO_3H_2, $CONR^7R^8$ and OH; each R^1, R^2, R^5 and R^6 is independently chosen from H, $(C_1\text{-}C_6)$alkyl, CO_2H, and hydroxy-substituted $(C_1\text{-}C_6)$alkyl; each R^3 and R^4 is independently chosen from H and $(C_1\text{-}C_6)$alkyl; m = 1-6; n = 1-6; R^7 and R^8 are independently chosen from H and $(C_1\text{-}C_3)$alkyl; and x = 1-6; provided that when Y^1 = OH, m = 3; provided that when Y^2 = OH, n = 3; and provided that when any of R^1, R^2, R^5 and R^6 is hydroxy-substituted $(C_1\text{-}C_6)$alkyl, the hydroxy group is bonded to a carbon atom that is at least gamma to a sulfur atom.

2. The composition of claim 1 further comprising a bath-soluble source of tin ions.

3. The composition of claim 1 wherein each R^1, R^2, R^5 and R^6 is independently chosen from H, $(C_1\text{-}C_4)$alkyl, CO_2H, and hydroxy-substituted $(C_1\text{-}C_4)$alkyl.

4. The composition of claim 1 wherein Y^1 and Y^2 are independently chosen from CO_2H, SO_3H, and PO_3H_2.

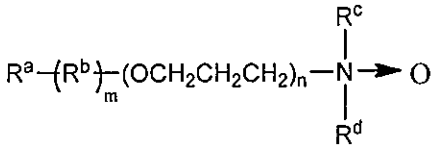
5. The composition of claim 1 wherein m = 1-4.

6. The composition of claim 1 wherein n = 1-4.

7. The composition of claim 1 wherein Y^1 and Y^2 are the same.

8. The composition of claim 1 wherein Y^1 and Y^2 are independently chosen from CO_2H, SO_3H, and OH; each R^1, R^2, R^5 and R^6 is independently chosen from H, $(C_1\text{-}C_3)$alkyl, and hydroxy-substituted $(C_1\text{-}C_3)$alkyl; each R^3 and R^4 is independently chosen from H and $(C_1\text{-}C_3)$alkyl; m = 1-4; n = 1-4; and x = 1-4.

9. The composition of claim 1 further comprising an alkoxylated amine oxide surfactant of the formula:



wherein R^a is selected from a $(C_6\text{-}C_{22})$alkyl group and a substituted $(C_7\text{-}C_{22})$aryl group; R^b is an alkoxylated unit; m is 0 to 7 and represents the number of moles of R^b; n is 0 or 1; and R^c and R^d are each at least one alkoxylated unit and the total number of alkoxylated units present in R^c and R^d is from 3 to 30.

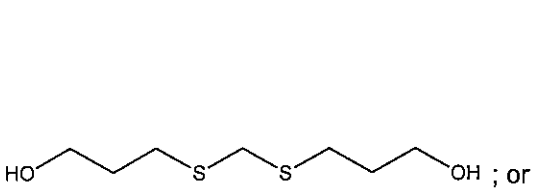
10. A method of depositing a tin-silver layer comprising: contacting a substrate with the composition of claim 1; applying a potential for a period of time to deposit a silver-containing layer on the substrate.

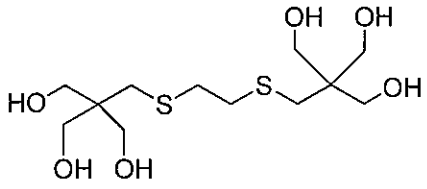
What is claimed is:

1. An electroplating composition comprising: a bath-soluble source of silver ions; water; acid electrolyte; and a sulfide compound chosen from the formulae:

$$Y^1\text{-}(CR^1R^2)_m\text{-}S\text{-}(CR^3R^4)_x\text{-}S\text{-}(CR^5R^6)_n\text{-}Y^2$$

wherein Y^1 and Y^2 are independently chosen from CO_2H, PO_3H_2, and $CONR^7R^8$; each R^1, R^2, R^5 and R^6 is independently chosen from H, $(C_1\text{-}C_6)$alkyl, CO_2H, and hydroxy-substituted $(C_1\text{-}C_6)$alkyl; each R^3 and R^4 is independently chosen from H and $(C_1\text{-}C_6)$alkyl; m = 1-6; n = 1-6; R^7 and R^8 are independently chosen from H and $(C_1\text{-}C_3)$alkyl; and x = 1-6; provided that when any of R^1, R^2, R^5 and R^6 is hydroxy-substituted $(C_1\text{-}C_6)$alkyl, the hydroxy group is bonded to a carbon atom that is at least gamma to a sulfur atom;



; or


.

2. The composition of claim 1 further comprising a bath-soluble source of tin ions.

3. The composition of claim 1 wherein each R^1, R^2, R^5 and R^6 is independently chosen from H, $(C_1\text{-}C_4)$alkyl, CO_2H, and hydroxy-substituted $(C_1\text{-}C_4)$alkyl.

4. The composition of claim 1 wherein Y^1 and Y^2 are independently chosen from CO_2H, and PO_3H_2.

5. The composition of claim 1 wherein m = 1-4.

6. The composition of claim 1 wherein n = 1-4.

7. The composition of claim 1 wherein Y^1 and Y^2 are the same.

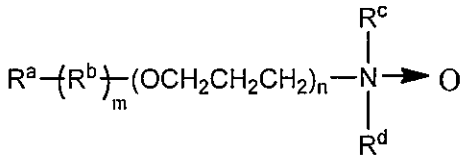
8. The composition of claim 1 wherein Y^1 and Y^2 are CO_2H; each R^1, R^2, R^5 and R^6 is independently chosen from H, $(C_1\text{-}C_3)$alkyl, and hydroxy-substituted $(C_1\text{-}C_3)$alkyl; each R^3 and R^4 is independently chosen from H and $(C_1\text{-}C_3)$alkyl; m = 1-4; n = 1-4; and x = 1-4.

9. An electroplating composition comprising a bath-soluble source of silver ions; water; acid electrolyte; and a sulfide compound of the formula:

$$Y^1\text{-}(CR^1R^2)_m\text{-}S\text{-}(CR^3R^4)_x\text{-}S\text{-}(CR^5R^6)_n\text{-}Y^2$$

wherein Y^1 and Y^2 are independently chosen from CO_2H, SO_3H, PO_3H_2, $CONR^7R^8$ and OH; each R^1, R^2, R^5 and R^6 is independently chosen from H, $(C_1\text{-}C_6)$alkyl, CO_2H, and hydroxy-substituted $(C_1\text{-}C_6)$alkyl; each R^3 and R^4 is independently chosen from H and $(C_1\text{-}C_6)$alkyl; m = 1-6; n = 1-6; R^7 and R^8 are independently chosen from H and $(C_1\text{-}C_3)$alkyl; and x = 1-6; provided that when Y^1 = OH, m = 3; provided that when Y^2 = OH, n = 3; and provided that when any of R^1, R^2, R^5 and R^6 is hydroxy-

substituted (C_1-C_6)alkyl, the hydroxy group is bonded to a carbon atom that is at least gamma to a sulfur atom; and an alkoxylated amine oxide surfactant of the formula:



wherein R^a is selected from a (C_6-C_{22})alkyl group and a substituted (C_7-C_{22})aryl group; R^b is an alkoxylated unit; m is 0 to 7 and represents the number of moles of R^b; n is 0 or 1; and R^c and R^d are each at least one alkoxylated unit and the total number of alkoxylated units present in R^c and R^d is from 3 to 30.

10. A method of depositing a silver layer comprising: contacting a substrate with the composition of claim 1; applying a potential for a period of time to deposit a silver-containing layer on the substrate.