We claim:

1. An electrodepositable coating composition comprising:

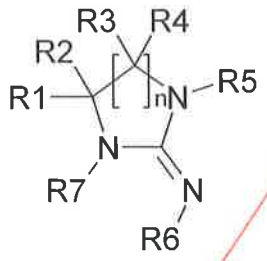
a reaction product of an epoxy functional polymer and a cyclic guanidine; and

a source of unreacted phenol,

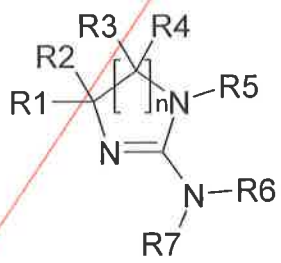
wherein the electrodepositable coating composition has a columbic usage of less than 100 coulombs/gram when deposited on a conductive substrate at a current density of $\leq$ 1.5 mAmps/cm^2.

2. The electrodepositable coating composition of claim 1, wherein the cyclic guanidine comprises structure (II), structure (III), or a combination thereof:

(II)



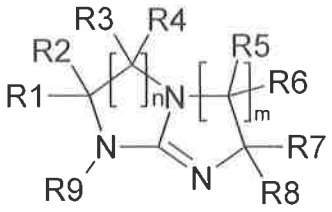
(III)



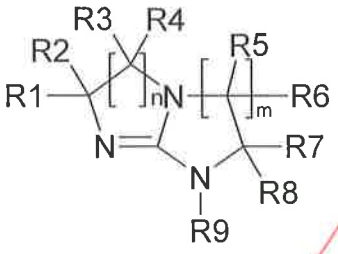
wherein each of R1, R2, R3, R4, R5, R6, R7 comprise hydrogen, (cyclo)alkyl, aryl, aromatic, organometallic, a polymeric structure, or together can form a cycloalkyl, aryl, or an aromatic structure, and wherein R1, R2, R3, R4 , R5, R6, and R7 can be the same or different, and wherein n $\geq$ 1.

3. The electrodepositable coating composition of claim 1, wherein the cyclic guanidine comprises structure (IV), structure (V), or a combination thereof:

(IV)



(V)



wherein each of R1, R2, R3, R4, R5, R6, R7, R8, or R9 comprises hydrogen, (cyclo)alkyl, aryl, aromatic, organometallic, a polymeric structure, or together can form a cycloalkyl, aryl, or an aromatic structure, and wherein R1, R2, R3, R4 , R5, R6, R7, R8, and R9 can be the same or different, and wherein n and m are both ≥ 1, and wherein n and m may be the same or different.

4. The electrodepositable coating composition of claim 1, wherein the cyclic guanidine comprises 1,5,7-triazabicyclo[4.4.0]dec-5-ene.

5. The electrodepositable coating composition of claim 1, further comprising a polymer and a curing agent.

6. The electrodepositable coating composition of claim 1, wherein the source of unreacted phenol comprises bisphenol-A, gallic acid, tannic acid, an epoxy-bound bisphenol A, or combinations thereof.

7. The electrodepositable coating composition of claim 1, wherein the source of unreacted phenol is present in an amount of at least 0.5 molar equivalent to 1 molar equivalent of the cyclic guanidine.

8. The electrodepositable coating composition of claim 1, wherein the source of unreacted phenol is present in an amount of at least 1 molar equivalent to 1 molar equivalent of the cyclic guanidine.

9. The electrodepositable coating composition of claim 1, wherein the source of unreacted phenol is present in an amount of more than 1 molar equivalent to 1 molar equivalent of the cyclic guanidine.

10. A substrate coated with the coating composition of claim 1.

11. The substrate according to claim 10, wherein the substrate is not pretreated with a phosphate or Group IIIB and/or Group IVB pretreatment solution prior to coating the substrate with the electrodepositable coating composition.

12. The substrate according to claim 10, wherein the substrate is pretreated with a phosphate or Group IIIB and/or Group IVB pretreatment solution prior to coating the substrate with the electrodepositable coating composition.

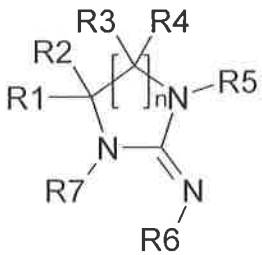
13. A method for coating a metal substrate comprising:

forming a reaction product comprising an epoxy functional polymer and a cyclic guanidine; and

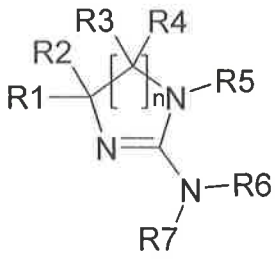
adding a source of unreacted phenol to the reaction product to form an electrodepositable coating composition.

14. The method according to claim 13, wherein the cyclic guanidine comprises structure (II), structure (III), or a combination thereof:

(II)



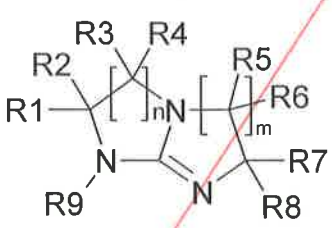
(III)



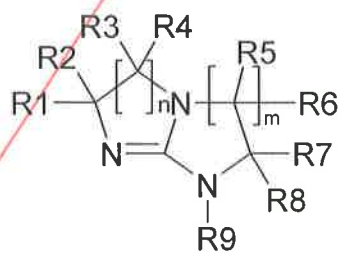
wherein each of R1, R2, R3, R4, R5, R6, R7 comprise hydrogen, (cyclo)alkyl, aryl, aromatic, organometallic, a polymeric structure, or together can form a cycloalkyl, aryl, or an aromatic structure, and wherein R1, R2, R3, R4 , R5, R6, and R7 can be the same or different, and wherein n ≥ 1.

15. The method according to claim 13, wherein the cyclic guanidine comprises structure (IV), structure (V), or a combination thereof:

(IV)



(V)



wherein each of R1, R2, R3, R4, R5, R6, R7, R8, or R9 comprises hydrogen, (cyclo)alkyl, aryl, aromatic, organometallic, a polymeric structure, or together can form a cycloalkyl, aryl, or an aromatic structure, and wherein R1, R2, R3, R4 , R5, R6, R7, R8, and R9 can be the same or different, and wherein n and m are both ≥ 1, and wherein n and m may be the same or different.

16. The method according to claim 13, wherein the reaction product further comprises a polymer and a curing agent.

17. The method according to claim 13, wherein the source of unreacted phenol comprises bisphenol-A, gallic acid, tannic acid, an epoxy-bound bisphenol A, or combinations thereof.

18. The method according to claim 13, wherein the source of unreacted phenol is added in an amount of at least 0.5 molar equivalent to 1 molar equivalent of the cyclic guanidine.

19. The method according to claim 13, wherein the source of unreacted phenol is added in an amount of at least 1 molar equivalent to 1 molar equivalent of the cyclic guanidine.

20. The method according to claim 13, wherein the source of unreacted phenol is added in an amount of more than 1 molar equivalent to 1 molar equivalent of the cyclic guanidine.

21. The method according to claim 13, further comprising electrophoretically depositing the electrodepositable coating composition onto the metal substrate.

22. The method according to claim 13, further comprising pretreating the metal substrate with a phosphate or zirconium pretreatment solution prior to coating the substrate with the electrodepositable coating composition.

We claim:

1. An electrodepositable coating composition comprising:

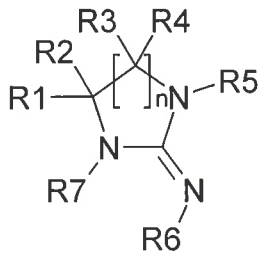
a reaction product of an epoxy functional polymer and a cyclic guanidine; and

a source of unreacted phenol,

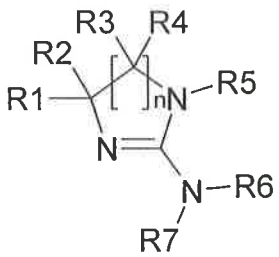
wherein the electrodepositable coating composition has a columbic usage of less than 100 coulombs/gram when deposited on a conductive substrate at a current density of $\leq$ 1.5 mAmps/cm^2.

2. The electrodepositable coating composition of claim 1, wherein the cyclic guanidine comprises structure (II), structure (III), or a combination thereof:

(II)



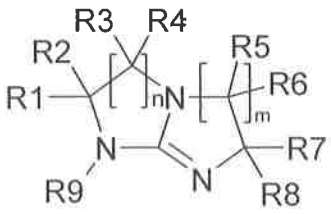
(III)



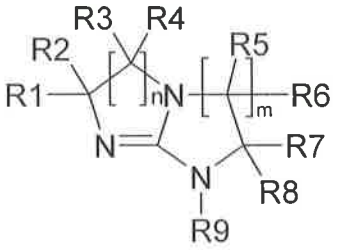
wherein each of R1, R2, R3, R4, R5, R6, R7 comprise hydrogen, (cyclo)alkyl, aryl, aromatic, organometallic, a polymeric structure, or together can form a cycloalkyl, aryl, or an aromatic structure, and wherein R1, R2, R3, R4 , R5, R6, and R7 can be the same or different, and wherein n $\geq$ 1.

3. The electrodepositable coating composition of claim 1, wherein the cyclic guanidine comprises structure (IV), structure (V), or a combination thereof:

(IV)



(V)



wherein each of R1, R2, R3, R4, R5, R6, R7, R8, or R9 comprises hydrogen, (cyclo)alkyl, aryl, aromatic, organometallic, a polymeric structure, or together can form a cycloalkyl, aryl, or an aromatic structure, and wherein R1, R2, R3, R4 , R5, R6, R7, R8, and R9 can be the same or different, and wherein n and m are both ≥ 1, and wherein n and m may be the same or different.

4. The electrodepositable coating composition of claim 1, wherein the cyclic guanidine comprises 1,5,7-triazabicyclo[4.4.0]dec-5-ene.

5. The electrodepositable coating composition of claim 1, further comprising a polymer and a curing agent.

6. The electrodepositable coating composition of claim 1, wherein the source of unreacted phenol comprises bisphenol-A, gallic acid, tannic acid, an epoxy-bound bisphenol A, or combinations thereof.

7. The electrodepositable coating composition of claim 1, wherein the source of unreacted phenol is present in an amount of at least 0.5 molar equivalent to 1 molar equivalent of the cyclic guanidine.

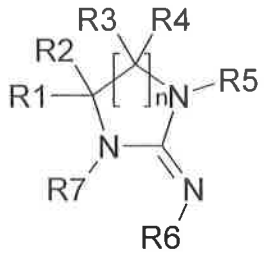
8. The electrodepositable coating composition of claim 1, wherein the source of unreacted phenol is present in an amount of at least 1 molar equivalent to 1 molar equivalent of the cyclic guanidine.

9. The electrodepositable coating composition of claim 1, wherein the source of unreacted phenol is present in an amount of more than 1 molar equivalent to 1 molar equivalent of the cyclic guanidine.

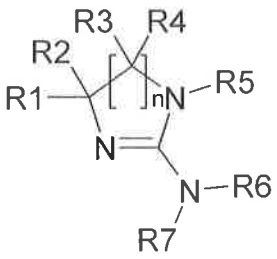
10. A method for coating a metal substrate comprising:
forming a reaction product comprising an epoxy functional polymer and a cyclic guanidine; and
adding a source of unreacted phenol to the reaction product to form an electrodepositable coating composition.

11. The method according to claim 10, wherein the cyclic guanidine comprises structure (II), structure (III), or a combination thereof:

(II)



(III)

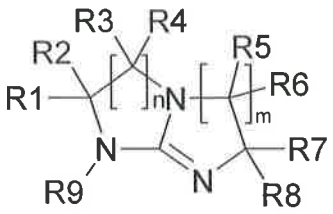


wherein each of R1, R2, R3, R4, R5, R6, R7 comprise hydrogen, (cyclo)alkyl, aryl, aromatic, organometallic, a polymeric structure, or together can form a cycloalkyl,

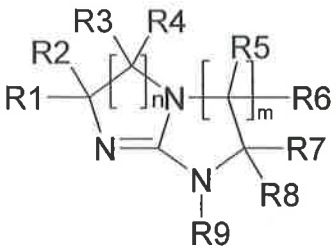
aryl, or an aromatic structure, and wherein R1, R2, R3, R4, R5, R6, and R7 can be the same or different, and wherein n≥1.

12. The method according to claim 10, wherein the cyclic guanidine comprises structure (IV), structure (V), or a combination thereof:

(IV)



(V)



wherein each of R1, R2, R3, R4, R5, R6, R7, R8, or R9 comprises hydrogen, (cyclo)alkyl, aryl, aromatic, organometallic, a polymeric structure, or together can form a cycloalkyl, aryl, or an aromatic structure, and wherein R1, R2, R3, R4, R5, R6, R7, R8, and R9 can be the same or different, and wherein n and m are both ≥1, and wherein n and m may be the same or different.

13. The method according to claim 10, wherein the reaction product further comprises a polymer and a curing agent.

14. The method according to claim 10, wherein the source of unreacted phenol comprises bisphenol-A, gallic acid, tannic acid, an epoxy-bound bisphenol A, or combinations thereof.

15. The method according to claim 10, wherein the source of unreacted phenol is added in an amount of at least 0.5 molar equivalent to 1 molar equivalent of the cyclic guanidine.

16. The method according to claim 10, wherein the source of unreacted phenol is added in an amount of at least 1 molar equivalent to 1 molar equivalent of the cyclic guanidine.

17. The method according to claim 10, wherein the source of unreacted phenol is added in an amount of more than 1 molar equivalent to 1 molar equivalent of the cyclic guanidine.

18. The method according to claim 10, further comprising electrophoretically depositing the electrodepositable coating composition onto the metal substrate.

19. The method according to claim 10, further comprising pretreating the metal substrate with a phosphate or zirconium pretreatment solution prior to coating the substrate with the electrodepositable coating composition.