

CLAIMS

1. A method, comprising:
placing a magnesium substrate into an anodizing bath;
5 applying a voltage for a first amount of time to form a micro-porous
anodizing layer having a thickness of between 1 to 50 microns on the
magnesium substrate;
placing the magnesium substrate with the micro-porous anodizing layer
in a plating bath, wherein the plating bath comprises a metal and a complexing
10 agent with a pH between 8 and 14;
applying a first current to the plating bath for a second amount of time to
form an interlock layer on the micro-porous anodizing layer; and
applying a second current to the plating bath for a third amount of time to
form a coating on the interlock layer.
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2. The method of claim 1, wherein magnesium substrate comprises a
magnesium alloy substrate.
3. The method of claim 1, wherein the anodizing bath comprises at least
20 one of sodium hydroxide or disodium metasilicate.
4. The method of claim 1, wherein the voltage is applied by a pulsed direct
current power supply.
- 25 5. The method of claim 1, wherein the pulsed direct current power supply
applies a constant current between 0.5 to 6 amperes per square decimeter at a
temperature of between 18 degrees Celsius to 30 degrees Celsius.
6. The method of claim 1, wherein the voltage has a peak voltage less than
30 75 volts.

7. The method of claim 6, wherein the anodizing bath comprises an organic agent to control the peak voltage.
8. The method of claim 1, wherein the complexing agent comprises at least one of: cyanide, pyrophosphate, or hydroxide.
9. The method of claim 1, wherein the first current follows a plating current profile to allow the interlock layer to fill micro-pores in the micro-porous anodizing layer.
10. The method of claim 1, wherein the second current is a constant current that is greater than the first current.
11. The method of claim 1, wherein the coating comprises a thickness between 5 to 50 microns.
12. A method, comprising:
pre-treating a magnesium substrate;
cleaning the magnesium substrate with de-ionized water;
forming a micro-porous anodizing layer on the magnesium substrate in an anodizing bath, wherein a voltage is applied to the anodizing bath for a first amount of time to form the micro-porous anodizing layer;
rinsing the magnesium substrate with the micro-porous anodizing layer;
forming an interlock layer on the micro-porous anodizing layer in an autocatalytic plating bath for a second amount of time, wherein the plating bath comprises a metal and a complexing agent with a pH between 8 and 14; and
forming a coating on the interlock layer in the autocatalytic plating bath, wherein a current is applied to the plating bath for a third amount of time to form the coating.
13. The method of claim 12, wherein the pre-treating comprises at least one of: treating the magnesium substrate in an acid bath, mechanically roughening

the magnesium substrate, or cleaning the magnesium substrate in an alkaline bath.

14. The method of claim 12, wherein the anodizing bath comprises at least one of sodium hydroxide or disodium metasilicate.

15. The method of claim 12, wherein the voltage has a peak voltage less than 75 volts.

16. The method of claim 15, wherein the anodizing bath comprises citric acid to control the peak voltage.

17. The method of claim 12, wherein the second amount of time is sufficient to fill pores of the anodizing layer.

18. The method of claim 12, wherein the autocatalytic plating bath comprises a nickel phosphorous bath or a nickel boron bath.

19. The method of claim 18, wherein the second current is between 0.1 amperes per square decimeter (A/dm^2) and 2 A/dm^2 .

20. A method, comprising:
placing a magnesium alloy substrate into an anodizing bath;
applying and maintaining a peak voltage below 75 volts for a first timer period of approximately 10 minutes to form a micro-porous anodizing layer having a thickness of between 5 to 15 microns on the magnesium alloy substrate;
placing the magnesium alloy substrate with the micro-porous anodizing layer in plating bath, wherein the plating bath comprises a metal and a complexing agent with a pH between 9 and 12;
applying a first current that is increased over a second time period from 0 amperes per square decimeter (A/dm^2) to between 0.01 A/dm^2 to 0.5 A/dm^2 to

the plating bath to form an interlock layer on the micro-porous anodizing layer;
and

applying a second current that is greater than the first current and
between 0.1 A/dm^2 and 2 A/dm^2 to the plating bath for a third time period to form
5 a coating on the interlock layer.