

CLAIMS

1. An aqueous slurry composition for the production of a multilayer coating on a substrate, comprising:
 - a basecoat slurry, comprising:
 - a basecoat binder comprising an aqueous solution of lithium doped potassium silicate, the binder characterized by an absence of hexavalent chromium (VI);
 - an aluminum powder or an aluminum alloy powder incorporated into the binder; and
 - a cure catalyst comprising nano-sized cerium oxide colloidal solution; and
 - a topcoat slurry, comprising:
 - a topcoat binder comprising an aqueous solution of a water-soluble phosphate-based compound, nitrate anions and a water-soluble compound of trivalent chromium (III);
 - a cure accelerating amine;wherein the topcoat slurry is characterized by an absence of hexavalent chromium (VI).
2. The aqueous slurry composition of claim 1, wherein the cure accelerating amine is a quaternary ammonium hydroxide that is selected from the group consisting of tetramethyl ammonium hydroxide $((\text{CH}_3)_4\text{NOH})$, triethylmethyl ammonium hydroxide $((\text{CH}_3\text{CH}_2)_3(\text{CH}_3)\text{NOH})$ and diethyldimethyl ammonium hydroxide $((\text{CH}_3\text{CH}_2)_2(\text{CH}_3)_2\text{NOH})$.
3. The aqueous slurry composition of claim 1, wherein the quaternary amine cure accelerator is in a range of about 0.1 – 5.0 weight % based on a total weight of the topcoat slurry.
4. The aqueous slurry composition of claim 1, further comprising one or more compounds that are a source of cationic species in an amount to create a pH of the aqueous slurry composition of about 1 – 2.5.
5. The aqueous slurry composition of claim 1, wherein the water-soluble compound of trivalent chromium (III) is in a concentration that is about 1 – 20 weight %, based on a total weight of the topcoat slurry.

6. The aqueous slurry composition of claim 1, further comprising particles of a metallic oxide pigment.
7. A multilayer coating composition, comprising:
 - a substrate;
 - a basecoat on said substrate, said basecoat comprising:
 - a ceramic basecoat matrix not containing hexavalent chromium, said ceramic basecoat matrix formed by a silicate binder, wherein said silicate binder is a potassium silicate doped with lithium;
 - a plurality of aluminum-containing particles embedded within said ceramic basecoat matrix; and
 - a cerium-containing compound, said cerium-containing compound impregnated into the ceramic basecoat matrix as a cerium-containing phase;
 - a topcoat, said topcoat comprising:
 - a topcoat ceramic matrix formed by curing a binder, said binder comprising a phosphate-based compound, nitrate containing species and a trivalent chromium (III) compound;
 - a cure accelerating amine; wherein the topcoat is characterized by an absence of hexavalent chromium (VI).
8. The multilayer coating composition of claim 7, wherein the cure accelerating amine is a quaternary amine selected from the group consisting of tetramethyl ammonium hydroxide $((\text{CH}_3)_4\text{NOH})$, triethylmethyl ammonium hydroxide $((\text{CH}_3\text{CH}_2)_3(\text{CH}_3)\text{NOH})$ and diethyldimethyl ammonium hydroxide $((\text{CH}_3\text{CH}_2)_2(\text{CH}_3)_2\text{NOH})$.
9. The multilayer coating composition of claim 7, wherein the topcoat further comprises pigment particles of a metallic oxide embedded in the topcoat matrix.
10. The multilayer coating composition of claim 7, wherein the topcoat is chemically compatible with the basecoat.
11. A method for applying a coating system onto a substrate, comprising:

applying an aqueous one-part basecoat slurry onto a surface of the substrate to form an applied layer, said aqueous one-part basecoat slurry comprising a lithium doped potassium silicate binder, the binder characterized by an absence of hexavalent chromium (VI); and an aluminum-containing powder incorporated into the binder;

treating the applied layer of the aqueous one-part basecoat slurry with a colloidal solution of a nano-sized cerium oxide to form a basecoat layer;

curing the basecoat layer;

applying a topcoat slurry onto the basecoat layer to form a topcoat layer, said topcoat slurry comprising an aqueous solution of a water-soluble phosphate-based compound, nitrate containing species, a compound of trivalent chromium (III) and a quaternary amine cure accelerator, the topcoat slurry characterized by an absence of hexavalent chromium (VI);

curing the topcoat layer.

12. The method of claim 11, wherein the curing of the basecoat layer and the curing of the topcoat layer occurs at below about 500 degrees F.

13. The method of claim 11, wherein the curing of the basecoat layer and the curing of the topcoat layer occurs at below about 400 degrees F.

14. The method of claim 11, incorporating pigment particles of a metallic oxide into the topcoat slurry.

15. The method of claim 11, wherein the quaternary amine is selected from the group consisting of tetramethyl ammonium hydroxide $((\text{CH}_3)_4\text{NOH})$, triethylmethyl ammonium hydroxide $((\text{CH}_3\text{CH}_2)_3(\text{CH}_3)\text{NOH})$ and diethyldimethyl ammonium hydroxide $((\text{CH}_3\text{CH}_2)_2(\text{CH}_3)_2\text{NOH})$.