CLAIMS

1. A method for producing a localized and platinum-group-metal (PGM) modified chromium diffusion coating onto selected regions of a substrate, comprising the steps of:

depositing a first platinum-group-metal (PGM) layer onto the surface of a substrate, said first (PGM) layer consisting of at least one element selected from the group consisting of platinum, iridium, rhodium, palladium and any combination thereof;

providing a chromium-containing slurry;

applying the chromium-containing slurry onto localized surfaces of said PGM layer of the substrate;

curing the slurry;

heating the cured slurry in a protective atmosphere to a predetermined temperature for a predetermined duration;

generating chromium-containing vapors;

diffusing chromium from said chromium-containing vapors into said localized surfaces of said PGM layer of the substrate to form the PGM modified chromium diffusion coating, said coating having a surface enrichment of both the chromium and the PGM, and further wherein said coating has a microstructure characterized by a substantial reduction in nitride and oxide inclusions and reduced levels of α-Cr phase in comparison to conventional chromizing processes.

2. The method of claim 1, wherein said method comprises locally applying a second coating onto the substrate.

3. The method of claim 2, wherein said second coating comprises an aluminide coating.

4. The method of claim 2, wherein said second coating comprises a MCrAlY coating.

5. The method of claim 1, wherein the step of applying the slurry comprises brushing, spraying, dipping, dip-spinning, injection, or any combination thereof.

6. The method of claim 1, wherein said localized surfaces are subject to corrosion attack.

7. A method for producing a localized platinum-group-metal (PGM) modified chromium diffusion coating onto a first region of a substrate and a localized PGM-modified aluminide diffusion coating onto a second region of a substrate, comprising the steps of:

depositing a first platinum-group-metal (PGM) layer onto the first region of the substrate, said PGM layer consisting of at least one element selected from the group consisting of platinum, iridium, rhodium, palladium, and any combination thereof;

providing a chromium-containing slurry;

applying the chromium-containing slurry onto the first region of said PGM layer of the substrate, wherein said step of applying the chromium-containing slurry is characterized by an absence of diffusion stop-off masking;

providing an aluminum-containing material;

heating the chromium-containing slurry and the aluminum-containing material in a protective atmosphere to a predetermined temperature for a predetermined duration;

diffusing chromium into the first region;

diffusing aluminum into the second region in the absence of diffusion stop-off masking;

forming the localized PGM modified chromium diffusion coating along the first region, said PGM modified chromium diffusion coating having a surface enrichment of both chromium and PGM and further wherein said coating has a microstructure characterized by a substantial reduction in nitride and oxide

inclusions and reduced levels of α-Cr phase in comparison to conventional chromizing processes; and

forming the localized PGM modified aluminide-diffusion coating along the second region.

8. The method of claim 7, wherein said first region is subject to corrosion attack.

9. The method of claim 7, wherein said second region is subject to oxidation attack.

10. The method of claim 7, wherein the step of applying the chromium-containing slurry comprises brushing, spraying, dipping, dip-spinning, injection or any combination thereof.

11. The method of claim 7, wherein said localized PGM modified chromium diffusion coating and said localized PGM modified aluminide diffusion coating are formed simultaneously during diffusion treatment.

12. The method of claim 7, wherein the substrate is a gas turbine blade and said first region comprises a shank.

13. The method of claim 11, wherein said second region comprises an airfoil.

14. A method for producing a localized PGM modified chromium diffusion coating and a localized PGM-modified aluminide diffusion coating onto selected regions of a blade simultaneously, said method comprising the steps of:

depositing a first platinum-group-metal (PGM) layer onto a shank of the blade, said PGM layer consisting of at least one element selected from the group consisting of platinum, iridium, rhodium, palladium, and any combination thereof

providing a chromium-containing slurry;

applying the chromium-containing slurry onto an external region of the shank of the blade, to create a partially coated blade;

providing aluminum-containing material within the retort;

loading the partially coated blade into the retort;

heating the partially coated blade;

generating aluminum containing vapors and chromium containing vapors;

diffusing chromium from the chromium-containing vapors into the external region of the shank of the blade;

diffusing aluminum from the aluminum-containing vapors into an airfoil of the blade;

forming the localized and PGM-modified chromium diffusion coating along the shank, said chromium diffusion coating having a surface enrichment of both chromium and PGM and further wherein said coating has a microstructure characterized by a substantial reduction in nitride and oxide inclusions and reduced levels of α-Cr phase in comparison to conventional chromizing processes; and

forming the localized PGM-modified aluminide-diffusion coating along the airfoil.

15. The method of claim 14, wherein said chromium-containing slurry is locally applied and characterized by an absence of diffusion-stop-off masking.

16. The method of claim 14, wherein said localized diffusion coating forms in the absence of diffusion-stop-off masking.

17. A method for producing a platinum-group-metal (PGM) modified chromium diffusion coating onto selected regions of a substrate, comprising the steps of:

providing a chromium-containing slurry;

applying the chromium-containing slurry onto localized surfaces of the substrate;

curing the slurry;

heating the cured slurry in a protective atmosphere to a predetermined temperature for a predetermined duration;

generating chromium-containing vapors;

diffusing the chromium from said chromium-containing vapors into said localized surfaces to form the chromium diffusion coating, said coating having a microstructure characterized by a substantial reduction in nitride and oxide inclusions and reduced levels of α-Cr phase in comparison to conventional chromizing processes;

depositing a PGM layer onto said chromium diffusion coating, said PGM layer consisting of at least one element selected from the group consisting of platinum, iridium, rhodium, palladium, and any combination thereof;

performing diffusion treatment in a protective atmosphere to a predetermined temperature for a predetermined duration, and diffusing the PGM into said chromium diffusion coating; and

producing said PGM-modified chromium diffusion coating onto the selected regions of the substrate, wherein said selected regions correspond to the localized surfaces.