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(54) ## TREATED GAS TURBINE COMPONENTS AND PROCESSES OF TREATING GAS TURBINE SYSTEMS AND GAS TURBINE COMPONENTS

(57) A process of treating a component (101) includes mechanically removing surface debris (109) from a base coating (105) of the component (101), identifying at least one surface feature (113) in the base coating (105), and applying an overlay coating layer (115) over the surface feature (113) of the base coating (105) without stripping off the base coating (105). A process of treating a gas turbine component (101) includes mechanically removing surface debris (109) from a base coating (105) of the gas turbine component (101), identifying at least one surface feature (113) in the base coating (105) of corrosion pits, dents, spalls, and combinations thereof, and applying an overlay coating layer (115) over the surface feature (113) of the base coating (105) without stripping off the base coating (105). A treated gas turbine component (101) includes a gas turbine component substrate (103) and a base coating (105) on the gas turbine component substrate (103) having at least one healed surface feature (113). The healed surface feature (113) includes an overlay coating layer (115) on the base coating (105).

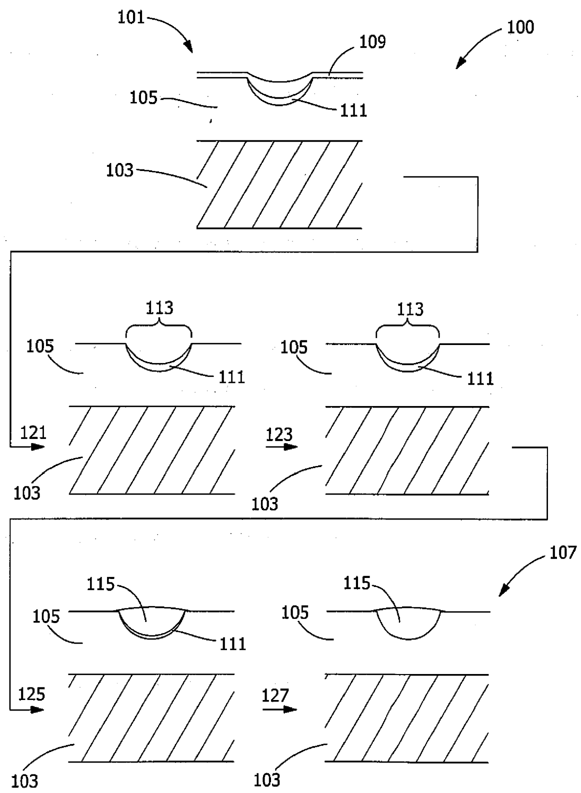

FIG. 1

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Description

FIELD OF THE INVENTION

[0001] The present embodiments are directed to methods of treatment and treated components. More specifically, the embodiments are directed to methods of treating a gas turbine component having a base coating and a treated gas turbine component.

BACKGROUND OF THE INVENTION

[0002] Gas turbine components are subjected to thermally, mechanically, and chemically hostile environments. For example, in the compressor portion of a gas turbine, atmospheric air is compressed, for example, to 10-25 times atmospheric pressure, and adiabatically heated, for example, to 427 - 677 °C (800 - 1250 °F), in the process. This heated and compressed air is directed into a combustor, where it is mixed with fuel. The fuel is ignited, and the combustion process heats the gases to very high temperatures, for example, in excess of 1650 °C (3000 °F). These hot gases pass through the turbine, where airfoils fixed to rotating turbine disks extract energy to drive the fan and compressor of the turbine and the exhaust system. The gases provide sufficient energy to rotate a generator rotor to produce electricity.

[0003] Gas turbines, such as aircraft engines and power generation systems, must satisfy the highest demands with respect to reliability, power, efficiency, economy, and operating service life. The use of coatings on turbine components, such as combustors, combustion liners, combustion transition pieces, combustion hardware, turbine blades (buckets), vanes (nozzles), and shrouds, is important in commercial as well as military gas turbine engines. Coatings, such as bond coatings and thermal barrier coatings (TBCs), contribute to desirable performance characteristics when operating in certain harsh environmental conditions. To avoid oxidation/corrosion damage at high temperatures, coatings have been applied to the surface of metallic components and cooling schemes have been implemented, so that the components function well and meet the designed life expectancy.

[0004] The bond coating is often a MCrAlY metallic bond coating, where M is Ni, Co or a combination thereof. Some conventional bond coatings, such as GT33 (available from Sulzer Metco, Westbury, New York), which is a MCrAlY bond coating alloy for turbine engine applications, have operational temperature limits of about 950 °C (1750 °F). At temperatures higher than the operational temperature limit, the bond coating deteriorates much faster due to accelerated oxidation, which increases the chances of spallation of the thermal barrier coating (TBC) applied to the bond coating and hence reduces the component service life. Typical MCrAlY bond coatings have a two-phase structure of fine γ-(M) (face-center cubic) and β-(M)Al (body-center cubic). The β-(M)Al phase is the aluminum (Al) reservoir.

[0005] Aluminum in the bond coating is depleted during service by diffusion either to the bond coating/TBC interface, forming α-Al_2O_3 a thermally grown oxide (TGO), or into the substrate. Spallation of the TBC occurs when the TGO layer is very thick or there is no more aluminum from the bond coating to form the adherent α-Al_2O_3 scale. Aluminum diffusion and TGO growth depend on bond coating temperatures, i.e., higher bond coating temperatures accelerate aluminum diffusion and TGO growth, and hence TBC spallation, and reduce component service life. Therefore, bond coating temperatures are limited due to oxidation, spallation, and depletion of the aluminum reservoir in the bond coating. High temperatures deplete β-phase material from the MCrAlY coatings. Upon reaching a predetermined depletion of the β-phase material, such MCrAlY coatings are treated.

[0006] Known MCrAlY coating treatment techniques include stripping MCrAlY coatings, for example, with an acid, and re-coating the article with a MCrAlY coating. Such techniques undesirably extend the duration of service periods for turbine components. Such stripping and re-coating can also result in undesirably high costs. The steps of stripping the old base coating and applying a new base coating accounts for more than 30 to 40% of the treatment cost for a turbine component. Thus, there is considerable cost saving potential in avoiding stripping off the old base coating. Furthermore, improper stripping and re-coating can have an undesirable effect on alloys in the substrate.

[0007] Corrosion pits in a service-returned base coating are a deterrent to life extension of the base coating. These coatings often include corrosion pits that may be due to any of a number of various causes including, but not limited to, small particle impingement, foreign object impingement, hot corrosion, particles coming from the gas and fuel, or combinations thereof.

BRIEF DESCRIPTION OF THE INVENTION

[0008] In an embodiment, a process of treating a component includes mechanically removing surface debris from a base coating of the component, identifying at least one surface feature in the base coating, and applying an overlay coating layer over the at least one feature of the base coating without stripping off the base coating.

[0009] In another embodiment, a treated gas turbine component includes a gas turbine component substrate and a base coating on the gas turbine component substrate having at least one healed surface feature. The healed surface feature includes an overlay coating layer on the base coating.

[0010] In another embodiment, a process of treating a gas turbine component includes mechanically removing surface debris from a base coating of the gas turbine component, identifying at least one surface feature in the base coating selected from the group consisting of corrosion pits, dents, spalls, and combinations thereof, and applying an overlay coating layer over the at least one feature of the base coating without stripping off the base coating.

[0011] Other features and advantages of the present invention will be apparent from the following more detailed description, taken in conjunction with the accompanying drawings which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a schematic view of a treatment process with a selectively-applied overlay coating in an embodiment of the present disclosure.

FIG. 2 is a schematic view of a treatment process where the heat treatment heals the base coating in an embodiment of the present disclosure.

FIG. 3 is a schematic view of a treatment process where applying a selectively-applied overlay coating heals the base coating in an embodiment of the present disclosure.

FIG. 4 is a schematic view of a treatment process with a uniformly-applied overlay coating in an embodiment of the present disclosure.

[0013] Wherever possible, the same reference numbers will be used throughout the drawings to represent the same parts.

DETAILED DESCRIPTION OF THE INVENTION

[0014] Provided is a process of extending the life of a base coating during treatment of a component with the base coating. The overlay coating preferably gives new life to the base coating and thereby enhances the overall coating life on the component and hence the performance of the component. In some embodiments, the component is a turbine component.

[0015] Embodiments of the present disclosure, for example, in comparison to concepts failing to include one or more of the features disclosed herein, enable life extension of a coating without having to strip and recoat, enable a practical and simple method of reusing an external coating, allow for a cost-effective treatment without additional steps being involved, allow for a faster turnaround time for treatment, allow for fewer process steps in the repair router, or any combination thereof.

[0016] As shown in FIG. 1 through FIG. 4, prior to being treated, a component 101 includes a substrate 103 and a base coating 105 positioned on at least a portion of the substrate 103. The base coating 105 may include at least one surface feature 113. The component 101 may also include surface debris 109 and the surface feature 113 may include a corrosion region 111. The component 101 may be any suitable component, including, but not limited to, a turbine component or an engine component. In some embodiments, the turbine component is a gas turbine component. Exemplary components include, but are not limited to, combustor liners, transition ducts (for example, between combustion and turbine sections), stationary nozzles, rotating buckets, shrouds, other metal or metallic components, or combinations thereof.

[0017] The component 101 is treated to form the treated component 107 according to the treatment process 100. The treatment process 100 may include mechanically removing surface debris 109 from the base coating 105 (step 121), identifying at least one surface feature 113 in the base coating 105 (step 123), and applying an overlay coating layer 115 over the surface feature 113 of the base coating 105 without stripping off the base coating 105 (step 125). The surface feature 113 may be, but is not limited to, at least one corrosion pit, dent, spall, cavity, discontinuity, porosity defect, shrinkage defect, scratch, void, impurity-derived fault, or combinations thereof.

[0018] The overlay coating layer 115 may be selectively applied to the surface feature 113, as shown in FIG. 1, FIG. 2, and FIG. 3, but may also be applied substantially uniformly to the rest of the base coating 105, as shown in FIG. 2. In some embodiments, the selectively-applied overlay coating layer 115 serves as a patch to patch one or more surface features 113 on the base coating 105. Alternatively, the overlay coating layer 115 may be applied substantially uniformly to the base coating 105, as shown in FIG. 4, such as when no surface features are identified, when surface features 113 are widespread over the base coating 105, or when the surface features are smaller than a predetermined dimension.

[0019] Applying the overlay coating layer 115 (step 125) may heal the surface feature 113 by removing some of the corrosion in the corrosion region 111, as shown in FIG. 1, or all of the corrosion, as shown in FIG. 3. In other embodiments, applying the overlay coating layer 115 (step 125) does not remove any of the corrosion in the corrosion region 111, as shown in FIG. 2 and FIG. 4. The treatment process 100 preferably also includes a heat treatment (step 127) to complete the healing process by removing any, most, or all of the remaining corrosion, as shown in FIG. 1, FIG. 2, and FIG. 4 and bonding the overlay coating layer 115 to the base coating 105.

[0020] The base coating 105 is preferably a bond coating and more preferably a MCrAlY bond coating. In some embodiments, the life of an external oxidation coating, including, for example, a GT33 MCrAlY bond coating, is extensible up to 96,000 hours without having to strip and recoat. A MCrAlY bond coating, as used herein, refers to a commercially available bond coating having a composition of about 30-35 wt% nickel, about 20-25 wt% chromium, about 8-12 wt% aluminum, about 0.1-0.5 wt% yttrium, and about 30-40 wt% cobalt. In some embodiments, the process enables coating life extension by healing the base coating 105, by adding an overlay coating layer 115 of the same type of coating, with a fewer number of passes, either via thermal spray or by using a gel coating. Application of the overlay (step 125) and subsequent heat treatment (step 127) serves to heal the base coating 105.

[0021] The treatment process 100, according to the present disclosure, enables treatment of the component 101 without stripping the base coating 105, even if the base coating 105 includes some corrosion pits. The treatment process 100 preferably retains and treats the base coating 105 and overcomes the corrosion that is found on the base coating 105.

[0022] In some embodiments, the base coating 105 is a damaged coating that was damaged during service. In some embodiments, the treatment repairs the damaged coating on the component. In some embodiments, the overlay coating layer 115 is a repair coating layer.

[0023] In some embodiments, a treatment process 100 includes removing a component 101 having a base coating 105 from service in the system, mechanically removing (step 121) surface debris 109 from the base coating 105, identifying (step 123) at least one surface feature 113 in the base coating 105 as a corrosion pit, dent, spall, cavity, discontinuity, porosity defect, shrinkage defect, scratch, void, impurity-derived fault, or combinations thereof, and applying (step 125) an overlay coating layer 115 over the surface feature 113 of the base coating 105 without stripping off the base coating 105. In some embodiments, the system is a turbine system. In some embodiments, the turbine system is a gas turbine system.

[0024] The state of the base coating 105 is often difficult to assess when a gas turbine component 101 is first removed from service. Mechanically removing (step 121) any surface debris 109 from the base coating 105 permits visual assessment and measurement of any surface features 113 on the base coating 105. Mechanically removing (step 121) surface debris 109 is preferably performed by a cosmetic grit blasting, preferably of the entire coated surface of the gas turbine component.

[0025] Once the surface debris 109 has been removed (step 121), surface features 113, including, but not limited to, corrosion pits, dents, spalls, cavities, discontinuities, porosity defects, shrinkage defects, scratches, voids, and impurity-derived faults, may be identified (step 123) and then characterized. Based on previous observations, 40 to 50% of gas turbine components removed from service are expected to have corrosion pits. Methods of identifying (step 123) these surface features 113 may include, but are not limited to, manually visually inspecting the surface; automatically inspecting the surface of the base coating 105, such as by an automated inspection directed by a computer using a visual sensor, a chemical sensor, or a topographical sensor; or combinations thereof, of the gas turbine component after mechanically removing (step 121) the surface debris 109. Characterization of these surface features 113 may include, but is not limited to, measuring the area, dimensions, or depth of the surface feature 113; assessing the presence or degree of corrosion in a corrosion region 111 present in the surface feature 113; or combinations thereof. In some embodiments, a depth gauge measures the depth of the surface feature 113. In some embodiments, the characterization includes accurately gauging the depth of a corrosion pit.

[0026] The type of overlay coating layer 115 and the method of application (step 125) are preferably then selected based on the assessed condition of the base coating 105 as a result of the identification (step 123) and characterization of any surface features 113. In some embodiments, the method of application (step 125) is selected based on the gauged depth of a surface feature 113, which may be a corrosion pit. In some embodiments, the method of application (step 125) is selected based on whether the gauged depth of the surface feature 113 is greater than or less than a predetermined depth. The overlay coating layer 115 is applied (step 125) over the at least one surface feature 113 of the base coating 105 without an acid rinse of the component 101 and without stripping off the base coating. Surface features 113 up to at least 75 to 100 microns (3 to 4 mils) in depth have been successfully treated on turbine components 101 by the treatment process 100.

[0027] When corrosion pits and other surface features 113 are observed, but observed to be few, sporadically located, or located in one or more clusters on the surface, the overlay coating layer 115 is preferably a gel aluminide applied (step 125) selectively as one or more patches only to the area or areas where the corrosion pits or other surface features 113 are located, as shown in FIG. 1 and FIG. 3.

[0028] When corrosion pits and other surface features 113 are observed to be somewhat spread around the component 101, the overlay coating layer 115 is preferably applied (step 125) over the entire base coating 105 by thermal spraying, although a thicker overlay coating layer 115 may be applied to the locations of one or more of the surface features 113, such as any surface features 113 larger than a predetermined size or deeper than a predetermined depth. The thermal spraying is preferably a high-velocity oxygen fuel (HVOF) spraying or a high-velocity air-fuel (HVAF) spraying, but other thermal spraying techniques, including, but not limited to, vacuum plasma spraying (VPS), may alternatively apply (step 125) the overlay coating layer 115. When corrosion pits and other surface features 113 are observed to be concentrated in one or more particular portions of the turbine component, the overlay coating layer 115 is preferably selectively applied (step 125) by thermal spraying to those particular portions rather than to the entire component 101.

[0029] In some embodiments, the thermal spray process of applying (step 125) the overlay coating layer 115 at a high temperature, by way of melting and solidification of the overlay coating, completely or partially heals the surface features 113 by dissolving some or all of one or more corrosion products located in or on a corrosion region 111 of the surface feature 113. In some embodiments, the corrosion product is the result of low temperature hot corrosion or high temperature hot corrosion. In some embodiments, the corrosion product resulted from operation with one or more elemental impurities in the system, which may include, but is not limited to, sodium, vanadium, sulfur, potassium, chlorine, lead, or combinations thereof. In some embodiments, the dissolved corrosion product may include, but is not limited to, sodium chloride (NaCl), sodium sulfate (Na_2SO_4), nickel sulfate ($NiSO_4$), cobalt sulfate ($CoSO_4$), vanadium (V) oxide (V_2O_5), sodium vanadate ($Na_2V_2O_6$), or combinations thereof. In some embodiments, the corrosion product resulted from operation with one or more contaminants in the system, which may include, but are not limited to, sand particles, calcium-magnesium aluminosilicate (CMAS), or combinations thereof. The applied overlay coating layer 115 preferably forms a molten pool on the surface feature 113 during the healing process.

[0030] In some embodiments, the overlay coating is a gel aluminide diffusion coating. The gel aluminide coating may be applied (step 125) selectively to only the regions with surface features 113, applied (step 125) substantially uniformly to the base coating 105, or applied (step 125) to the entire base coating 105 as a thin layer over most of the base coating 105 but as a thicker layer selectively applied (step 125) over one or more surface features 113. A heat treatment (step 127) of the component 101 after application of the aluminide diffusion coating preferably bonds the overlay coating layer 115 to the base coating 105 and heals the surface features 113 to form the treated component 107.

[0031] In some embodiments, the base coating 105 is observed to contain no surface features 113 or only surface features 113 that are smaller than a predetermined size, that have no corrosion, or that have less corrosion than a predetermined level such that no overlay coating or only a thin overlay coating layer 115 is applied to the base coating 105. The thin overlay coating layer 115 preferably has a thickness less than 100 microns (4 mils), alternatively less than 75 microns (3 mil), alternatively less than 50 microns (2 mil), alternatively in the range of 25 to 50 microns (1 to 2 mils), or any suitable combination, sub-combination, range, or sub-range thereof. In some embodiments, the thin overlay coating 115 is a MCrAlY coating applied (step 125) by a thermal spraying technique or a gel aluminide coating, preferably followed by a heat treatment (step 127) of the component.

[0032] In some embodiments, the component 101 is a gas turbine component and the treated component 107 is a treated gas turbine component.

[0033] In some embodiments, a treated gas turbine component includes a gas turbine component substrate 103 and a base coating 105 on the gas turbine component substrate 103 having at least one healed surface feature 113. The healed surface feature 113 includes an overlay coating layer 115 on the base coating 105.

[0034] In some embodiments, a treatment process 100 for a gas turbine component 101 includes mechanically removing (step 121) surface debris 109 from a base coating 105 of the gas turbine component 101, identifying (step 123) at least one surface feature 113 in the base coating 105 as a corrosion pit, dent, spall, cavity, discontinuity, porosity defect, shrinkage defect, scratch, void, or impurity-derived fault, and applying (step 125) an overlay coating layer 115 over the surface feature 113 of the base coating 105 without stripping off the base coating 105.

[0035] In some embodiments, the base coating 105 is a MCrAlY bond coating alloy, where M is nickel, cobalt, iron, alloys thereof, or combinations thereof. In some embodiments, the MCrAlY bond coating alloy is GT33. In some embodiments, the base coating 105 is a corroded coating with at least one corrosion region 111. The base coating 105 is overlaid, at least in part, with an overlay coating layer 115.

[0036] In some embodiments, the overlay coating layer 115 is a MCrAlY bond coating alloy, where M is nickel, cobalt, iron, alloys thereof, or combinations thereof, applied to cover at least the corrosion pits on the existing coating. In some embodiments, the overlay coating layer 115 is GT33. In some embodiments, the thickness of the overlay coating layer 115 is in the range of 25-125 microns (1-5 mil). In some embodiments, the applied overlay coating is MCrAlY applied (step 125) using the same application technique as the application technique used to apply the base coating 105.

[0037] In some embodiments, the overlay coating layer 115 is applied (step 125) by one or more thermal spraying techniques. In some embodiments, the thermal spraying technique is high-velocity oxygen fuel (HVOF) spraying, vacuum plasma spraying (VPS), high-velocity air-fuel (HVAF) spraying, wire arc spraying, flame/combustion spraying, or any combinations thereof. The thermal spraying technique preferably heats the overlay material to a temperature of at least 1900 °C (3450 °F), alternatively to at least 2000 °C (3650 °F), In some embodiments, the HVOF spraying technique heats the overlay material to the range of about 2750 °C to about 3600 °C (5000-6500 °F), alternatively about 2750 °C to about 3300 °C (5000-6000 °F), alternatively about 2750 °C to about 3050 °C (5000-5500 °F), alternatively about 3050 °C to about 3300 °C (5500-6000 °F), alternatively about 3300 °C to about 3600 °C (6000-6500 °F), or any suitable combination, sub-combination, range, or sub-range thereof. In some embodiments, the HVAF spraying technique heats the overlay material to the range of about 1900 °C to about 2000 °C (3450-3550 °F), alternatively about 1900 °C to about 1950 °C (3450-3550 °F), alternatively about 1950 °C to about 2000 °C (3550-3650 °F), or any suitable combination, sub-combination, range, or sub-range thereof.

[0038] In some embodiments, the applied overlay coating is an aluminide. In such embodiments, the overlay coating may be a slurry, a gel, or any other suitable material capable of application to the base coating 105, such as vapor phase deposition. In some embodiments, the overlay coating is a gel aluminide coating applied to cover the corrosion pits on the existing base coating 105. The aluminide in the overlay coating is preferably NiAl or Ni_2Al_3. In some embodiments, the overlay coating includes aluminum at a concentration, by weight, of about 8% to about 35%, alternatively about 12% to about 32%, alternatively about 15% to about 25%, alternatively about 15% to about 20%, alternatively about 20% to about 25%, alternatively about 20% to about 30%, alternatively about 25% to about 30%, alternatively about 15%, alternatively about 20%, alternatively about 25%, alternatively about 30%, or any suitable combination, sub-combination, range, or sub-range thereof.

[0039] The base coating 105 may be soaked or dipped in the overlay coating. Alternatively, the overlay coating may be poured, sprayed, or brushed onto the base coating 105, and/or applied by any other application process capable of applying (step 125) the overlay coating. In some embodiments, the overlay coating diffuses into the base coating 105, for example, by a diffusion depth. The diffusion depth may be at least about 25 microns (1 mil), alternatively at least about 38 microns (1.5 mils), alternatively at least about 50 microns (2 mils), alternatively about 25 microns (1 mil), alternatively about 38 microns (1.5 mils), alternatively about 50 microns (2 mils), alternatively within a range of about 25 microns (1 mil) to about 50 microns (2 mils), alternatively within a range of about 25 microns (1 mil) to about 38 microns (1.5 mils), alternatively within a range of about 38 microns (1.5 mils) to about 50 microns (2 mils), or any suitable combination, sub-combination, range, or sub-range thereof.

[0040] In some embodiments, the applying (step 125) of the overlay coating is under operational conditions. In some embodiments, the overlay coating is applied (step 125) for a predetermined duration, such as, for example, about 1 to about 6 hours, about 1 to about 3 hours, about 3 to about 6 hours, about 1 hour, about 3 hours, about 6 hours, or any suitable combination, sub-combination, range, or sub-range thereof. In some embodiments, the applying (step 125) of the overlay coating is followed by or done while heating the overlay coating and/or the component 101. For example, in one embodiment, the component 101 is positioned in an atmospheric furnace and the heating is performed, for example, in an inert atmosphere, such as with argon gas and/or with low oxygen content. In some embodiments, the heating is performed under a reduced pressure or a vacuum.

[0041] The treatment process 100 preferably further includes heat treating (step 127) at a predetermined elevated temperature to form a treated protective coating on the treated component 107. Post-coat heat treatment (step 127) of the overlay coating preferably restores or tends to heal the base coating 105 to have equal or substantially equal properties to a new base coating. In some embodiments, the healing includes precipitation of a beta phase during the heat treatment (step 127) in the new base coating, such as to a similar state as in the original base coating 105. Heat treating (step 127) may include, for example, heating with a furnace to bring up the temperature of the gas turbine component. The heat treatment (step 127) preferably alters the metal of the base coating 105 or substrate 103 to allow the material from the diffusion zone to flow into the base coating 105 or substrate 103 and bond with the base coating material to form a treated protective coating. The treated protective coating may have a coating microstructure and a coating chemistry matching an original coating of a new gas turbine component prior to service in a turbine.

[0042] A heat treatment (step 127) includes suitable temperatures, for example, temperatures of about 870 °C to about 1200 °C (1600 °F to 2200 °F), alternatively about 1040 °C to about 1180 °C (1900 °F to 2150 °F), alternatively about 1070 °C to about 1150 °C (1950 °F to 2100 °F), alternatively at about 1080 °C (1975 °F), alternatively at about 1090 °C (2000 °F), alternatively at about 1120 °C (2050 °F), or any suitable combination, sub-combination, range, or sub-range thereof. In one embodiment, heat treating (step 127) is at a temperature capable of forming a ductile intermetallic material, such as a ductile aluminide, for example, having a strain range of about 4% and/or permitting the treated component 107 to be devoid or substantially devoid of cracking formed by application of a brittle aluminide.

[0043] In some embodiments, the applying (step 125) of the overlay coating and the heating (step 127) heals the surface feature 113 region of the base coating 105 to form the treated component 107. The formation of the treated component 107 preferably includes outwardly forming β-phase material as the outwardly-formed β-phase material from the base coating 105 into the aluminide overlay coating layer 115. Use of the term "outwardly" refers to having a greater characteristic of outward forming β-phase material than inward formed coatings which include NiAl and Ni_2Al_3 β-phase material. For example, outwardly-formed aluminides include primarily β-NiAl as nickel diffuses outward to react with the aluminum source.

[0044] The component 101 for the treatment process 100 may be any suitable coated component. In some embodiments, the component 101 is a gas turbine component. In some embodiments, the component 101 is a stage 1 (S1) turbine bucket of a gas turbine system. The component 101 has preferably been used in service for at least a predetermined period of time before being subjected to the treatment process 100.

[0045] While the invention has been described with reference to one or more embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims. In addition, all numerical values identified in the detailed description shall be interpreted as though the precise and approximate values are both expressly identified.

Claims

1. A process of treating a component (101) comprising:

mechanically removing surface debris (109) from a base coating (105) of the component (101);
identifying at least one surface feature (113) in the base coating (105); and
applying an overlay coating layer (115) over the at least one surface feature (113) of the base coating (105) without stripping off the base coating (105).

2. The process of claim 1 wherein the applying comprises an applying technique that is the same as the applying technique used to apply the base coating (105).

3. The process of claim 1 wherein the applying comprises thermal spraying.

4. The process of claim 3 wherein the applying comprises selectively applying the overlay coating layer (115) to cover the at least one surface feature (113).

5. The process of claim 1 wherein the at least one surface feature (113) comprises at least one corrosion pit and the applying comprises applying the overlay coating layer (115) to the at least one corrosion pit and dissolving at least a portion of corrosion products present therein.

6. The process of claim 1 wherein the surface feature (113) is selected from the group consisting of at least one corrosion pit, dent, spall, cavity, discontinuity, porosity defect, shrinkage defect, scratch, void, impurity-derived fault, or combinations thereof.

7. A treated gas turbine component (101) comprising:

a gas turbine component substrate (103); and
a base coating (105) on the gas turbine component substrate (103) having at least one healed surface feature (113);

wherein the healed surface feature (113) includes an overlay coating layer (115) on at least one surface feature (113) of the base coating (105).

8. The treated gas turbine component (101) of claim 13 wherein the healed surface feature (113) includes dissolved corrosion products.

9. A process of treating a gas turbine component (101) comprising:

mechanically removing surface debris (109) from a base coating (105) of the gas turbine component (101);
identifying at least one surface feature (113) in the base coating (105) selected from the group consisting of at least one corrosion pit, dent, spall, cavity, discontinuity, porosity defect, shrinkage defect, scratch, void, impurity-derived fault, or combinations thereof; and
applying an overlay coating layer (115) over the at least one surface feature (113) of the base coating (105) without stripping off the base coating (105).

10. The process of claim 18 wherein the applying comprises applying the overlay coating layer (115) to at least one corrosion pit and dissolving at least a portion of corrosion products present therein.

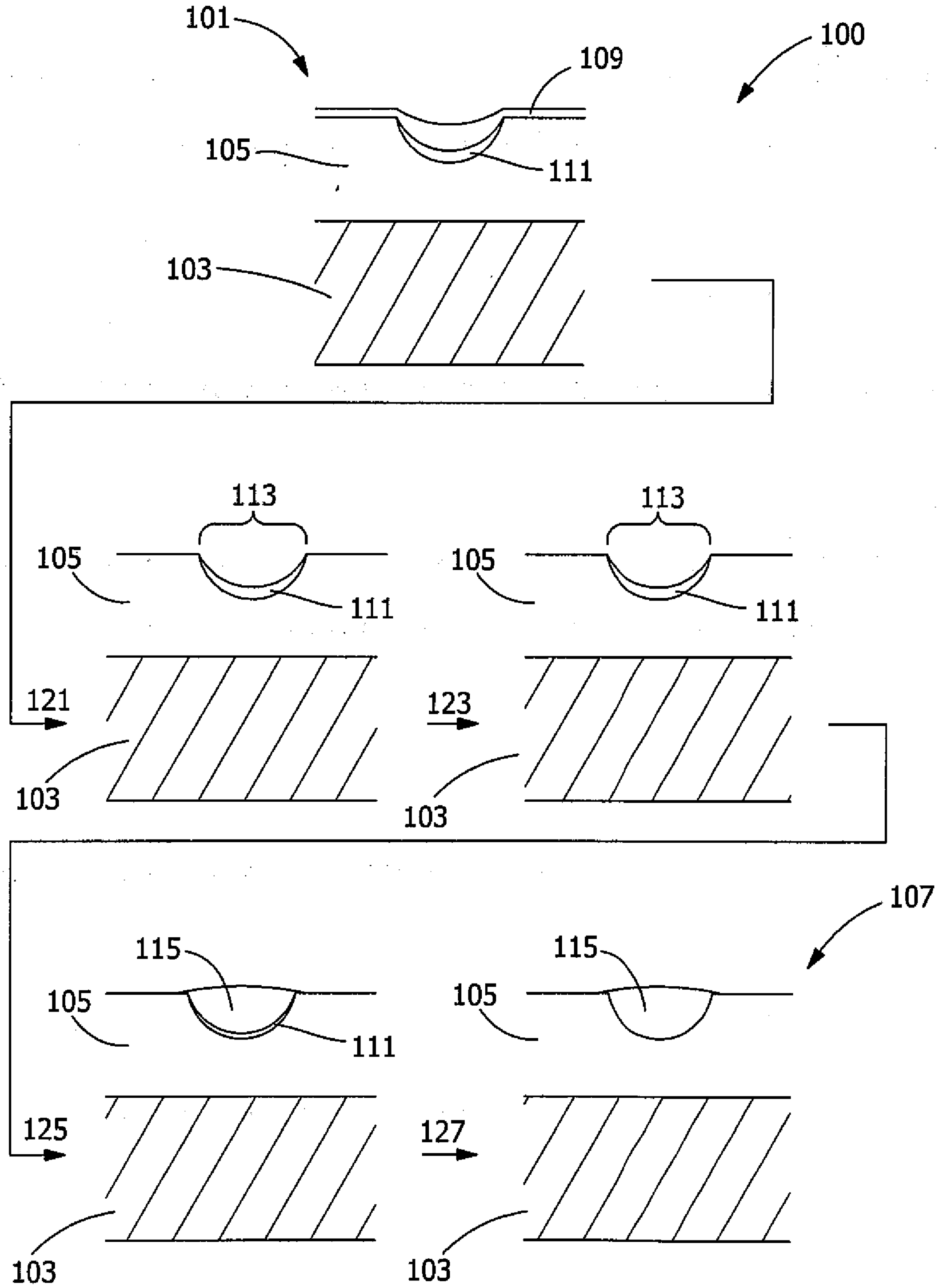
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FIG. 1

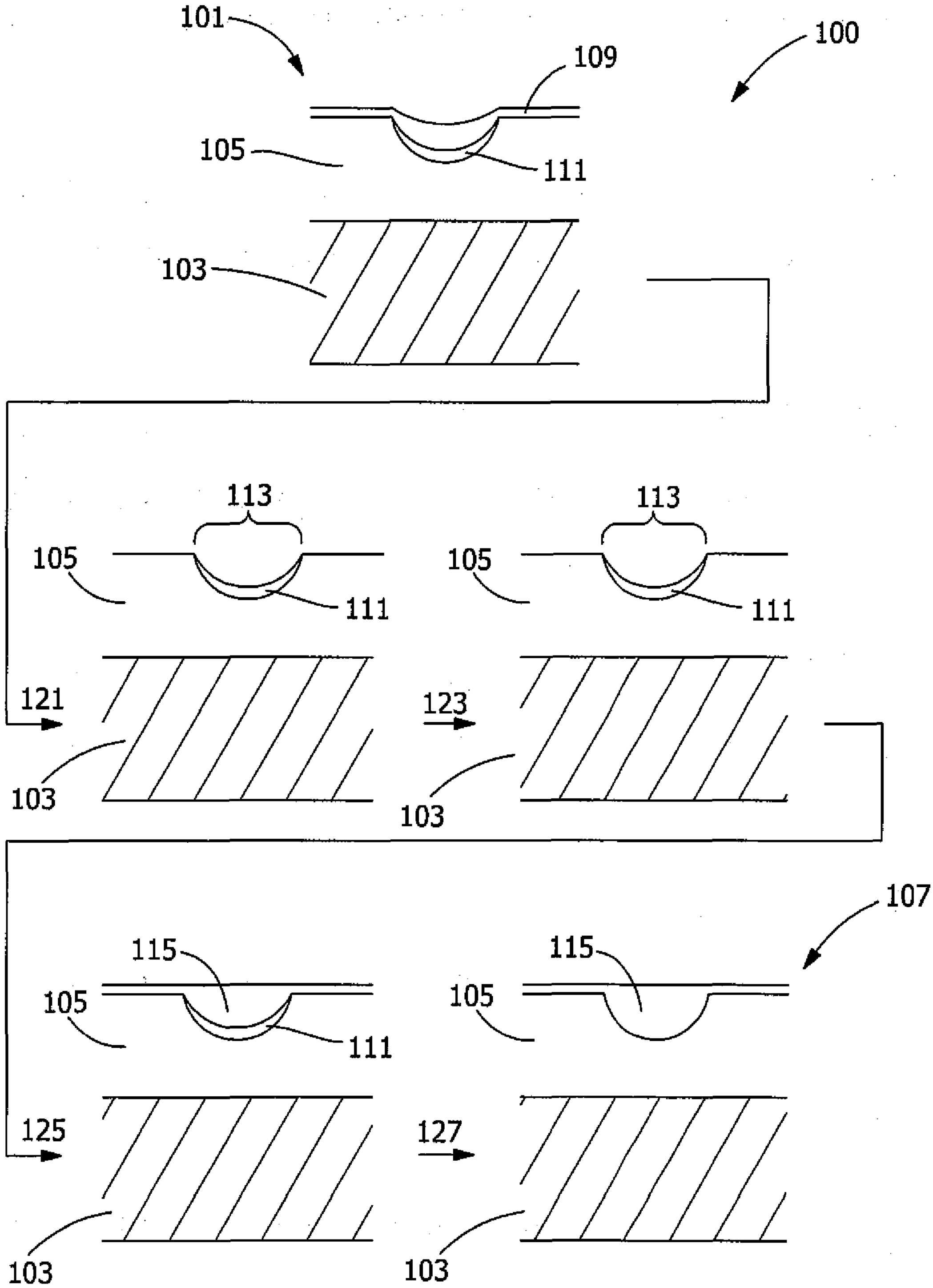
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FIG. 2

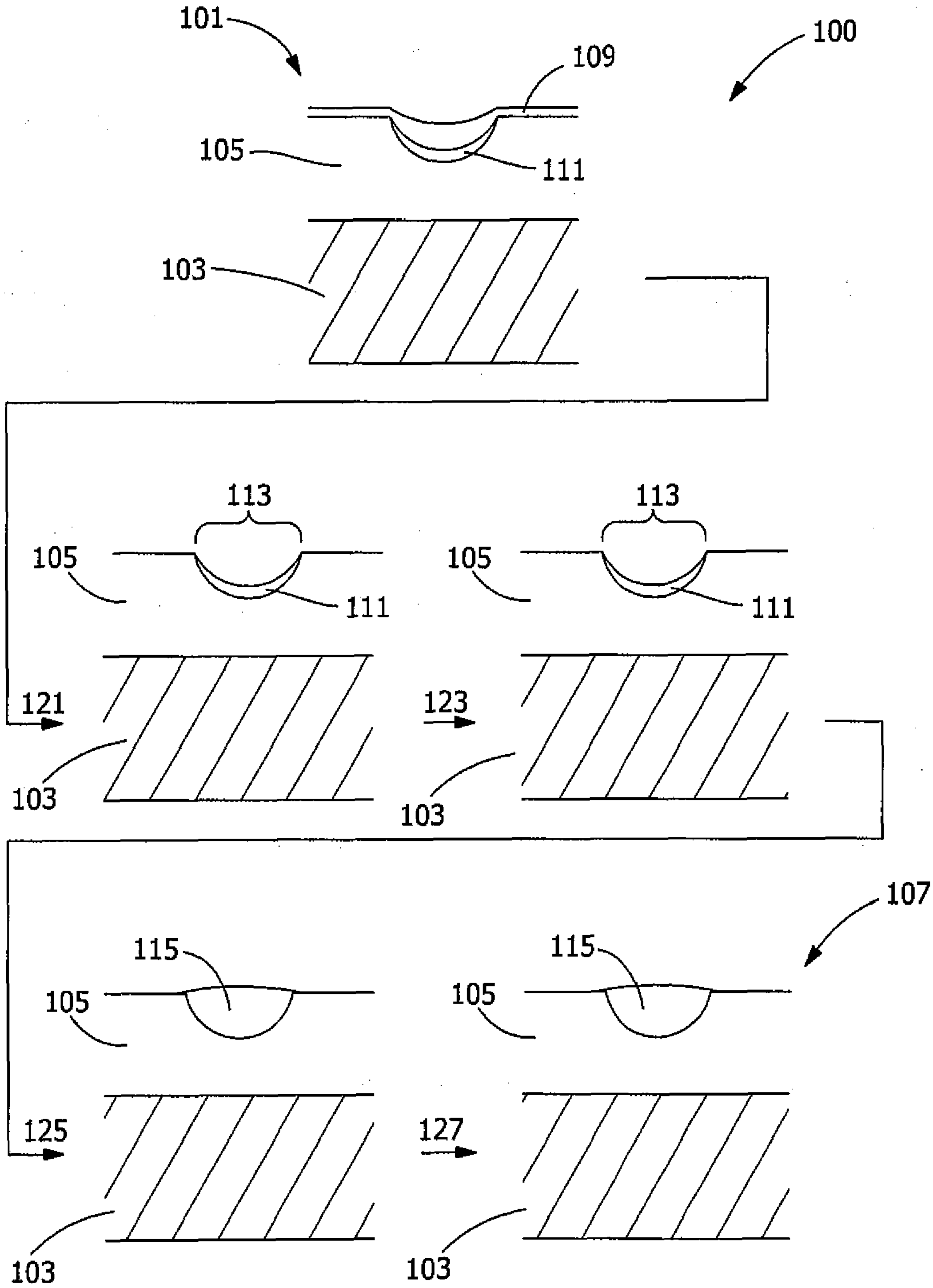
101
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FIG. 3

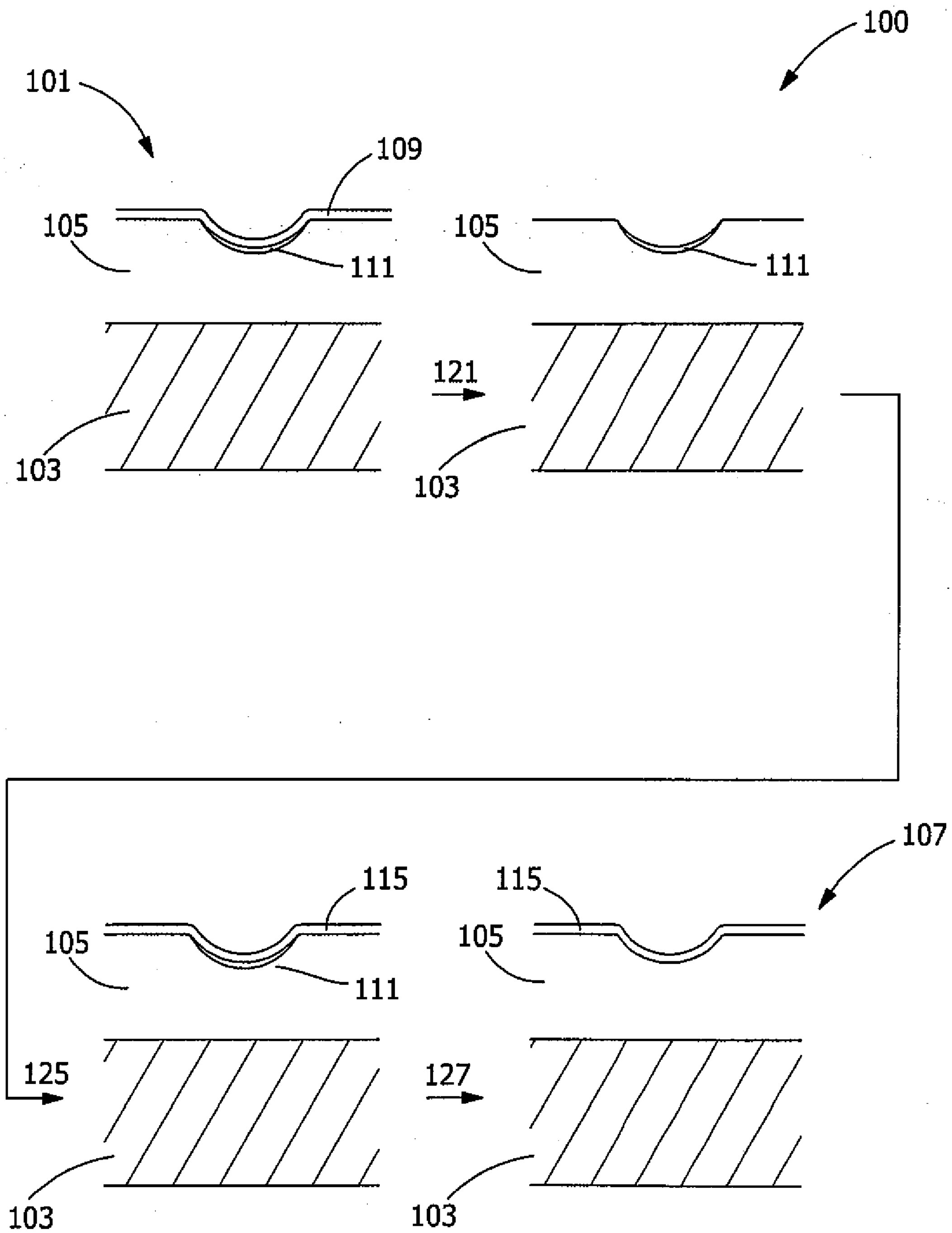
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FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 16 46 1527

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C23C
F01D

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	25 November 2016	Calabrese, Nunziante

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