Selected Patents Related to Thermal Spraying

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US denotes U.S. patent, WO denotes World Organization patent, EP denotes European patent, GB denotes Great Britain patent, RU denotes patent of Russian Union, and JP denotes Japanese patent. Due to differences in databases, not all data are available for each patent.

Applications

Biomedical Implants

Biomedical Implant Material and Method of Producing the Same. The present invention provides a biomedical implant material comprising a substrate for biomedical implant made of a ceramic material, a first coating layer formed on the surface of said substrate by low thermal impact coating process, and a second coating layer formed on said first coating layer via a metallic layer formed by thermal spraying process, and a method of producing the same. According to the biomedical implant material, it is possible to prevent cracks from occurring in the ceramic substrate and to secure sufficient bonding strength between the thermal sprayed layer of titanium or the like onto the ceramic substrate.

US6534197. I. Noda, J. Ikeda, T. Nakanishi, H. Kitano, and S. Masuda. Company: Kyocera Corp., Kyoto, Japan. Issued/Filed: 18 March 2003/26 March 2001

Brake Linings

Drum Brake Linings Having Thermally or Mechanically Applied Metallic Shoe Attachment Enhancements. Drum brake linings having an integral surface texture on the friction side surface of a drum brake shoe are described. The surface texture may be achieved by spraying metal droplets onto the surface, fusing a metal pattern onto the surface, or creating a series of protrusions by scraping or cutting the surface. The surface textures have excellent shear strength and retention profiles.

US20030057038A1. S.K. Kesavan, R.A. Eastham, and K.L. Fairless. Issued/Filed: 27 March 2003/25 Sept 2001.

Casting Repairs

Method of Salvaging Castings with Defective Cast Cooling Bumps. Castings for gas turbine parts exposed on one side to a high-temperature fluid medium have cast-in bumps on an opposite cooling surface side to enhance heat transfer. Areas on the cooling surface having defectively cast bumps, that is, missing or partially formed bumps during casting, are thermally sprayed to provide a metallic cooling enhancement surface layer to salvage the part.

US6537619. R.A. Johnson, J.C. Schaeffer, C.-P. Lee, and N. Abuaf. Company: General Electric Co., Schenectady, NY. Issued/Filed: 25 March 2003/13 April 2001.

Catalysts

Catalyst Element Having a Thermal Barrier Coating as the Catalyst Substrate. A combustion catalyst coating applied to the surface of a ceramic thermal barrier coating that is supported by a metal substrate. The microstructure of the thermal barrier coating surface provides the necessary turbulent flow and surface area for interaction of the catalyst and a fuel-air mixture in a catalytic combustor of a gas turbine engine. The temperature gradient developed across the thermal barrier coating protects the underlying metal substrate from a high-temperature combustion process occurring at the catalyst surface. The thermal barrier coating deposition process may be controlled to form a microstructure having at least one feature suitable to interdict a flow of fuel-air mixture and cause the flow to become more turbulent than if such feature did not exist.

US20030056520A1. C. Campbell, R. Subramanian, and A.J. Burns. Issued/Filed: 27 March 2003/30 May 2002.

Substrate Having Catalyst Compositions on Surfaces of Opposite Sides and Method for Producing the Same. A bilaterally surfaced substrate in which the first surface consists of one or more than one of cerium oxide, aluminum oxide, tin oxide manganese oxide, copper oxide, cobalt oxide, nickel oxide, praseodymium oxide, terbium oxide, ruthenium, rhodium, palladium, silver, iridium, platinum, and gold, and the second surface consists of one or more than one of ruthenium, rhodium, palladium, silver, iridium, platinum, and gold, and microchannel microcomponent reactors including such substrates in a predetermined formed shape and methods for making the same, utilizing a thermal spray on one side and a physical deposition process on the other side.

WO03024590A1 and US20030054953A1. T. He, E. Kimura, and T. Nomura. Company: Honda Giken Kabushiki Kaisha, Tokyo, Japan. Issued/Filed: 20 March 2003/20 Sept 2001.

Metal Oxide and Noble Metal Catalyst Coatings. A substrate having a catalytic surface having a coating of metal oxide and noble metal particles in the nominal diameter size distribution range of less than 3 μm, preferably less than 1 μm is produced by thermal spraying a mixture of large size particles (>10 μm in nominal size distribution range) of hydroxides, carbonates, or nitrates of the metals: cerium, aluminum, tin, manganese, copper, cobalt, nickel, praseodymium, or terbium particles, and hydroxides, carbonates, or nitrates of the noble metals: ruthenium, rhodium, palladium, silver, iridium, platinum, and gold onto the substrate. The coating adheres to the surface and provides desirable catalyst properties.

WO03009934A1. T. He. Company: Honda Giken Kabushiki Kaisha, Tokyo, Japan. Issued/Filed: 6 Feb 2003/23 July 2002.

Coated Implant

Coated Implantable Medical Device. A coated implantable medical device includes a structure adapted for introduction into the vascular system, esophagus, trachea, colon, biliary tract, or urinary tract, and at least one layer of an immunosuppressive agent posited over at least one surface of the structure. Optionally, the device can include at least one porous, preferably polymeric layer posited over the layer of immunosuppressive agent, and can alternatively or additionally include at least one coating layer posited on one surface of the structure, at least one layer of immunosuppessive agent being posited in turn on at least a portion of the coating layer. The porous layer and the coating layer each provide for the controlled release of the bioactive material from the device. The structure is preferably configured as a coronary stent. The polymer of the porous layer is preferably applied by vapor or plasma deposition. It is particularly preferred that the polymer is a polyamide, parylene, or a parylene derivative that is deposited without solvents, heat, or catalysts, but rather by condensation of a monomer vapor.

US20030036794A1. A.O. Ragheb, N.E. Fearnot, W.D. Voorhees, T.G. Kozma, B.L. Bates, and T.A. Osborne. Company: Cook Inc., Bloomington, IN. Issued/Filed: 20 Feb 2003/19 Aug 2002.

Cylinder Heads

Method for Making a Cylinder Head with Integrated Valve Seats and Cylinder Head with Integrated Valve Seats. Method of manufacture of a cylinder head in light alloy comprising integrated valve seats, characterized in that it comprises obtaining a rough cast cylinder head in light alloy comprising valve seat areas; deposition onto the seat areas by transferred plasma arc of a coating layer of an alloy having the following composition, in percentages by weight: Ni 13-20, Mo 2-8, Co 0-10, Fe 2-8, Si 2-4, B 1-3, and Cu complement; and machining of the coating layer in order to obtain the desired geometry and surface state for the integrated valve seats.

EP0995027B1. A. Ben and P. Cachot. Company: Renault S.A.S. Issued/Filed: 12 March 2003/12 June 1998.

Detection Device

Device for Measuring Combustible-Gas Concentration in an Exhaust Gas. A device and method for measuring combustible-gas concentration and a device and method for measuring hydrocarbon-gas concentration, which exhibit low dependence on oxygen concentration variations as well as low temperature dependence. Paste is applied to the inner surface of a closed-bottom cylindrical solid electrolyte element, thereby forming a layer serving as a reference electrode. Plating with platinum is performed so as to form a layer serving as a first detection electrode, on the outer surface of the solid electrolyte element only at a portion extending from an end portion of the solid electrolyte element to the vicinity of the interface between a heating resistor and a heating-resistor lead portion, which are formed within a heater element contained in the cylindrical solid electrolyte element. Paste that contains gold powder and 10 parts of indium oxide is applied onto the platinum plating layer so as to form a layer serving as a second detection electrode, followed by firing. Subsequently, a diffusion layer containing spinel is formed by thermal spraying on the surface of a detection electrode. The heater element is disposed in the solid electrolyte element such that an end portion abuts an inner bottom portion of the solid electrolyte element. Lead wires for measuring internal resistance, which extend from the reference electrodes, and a lead wire extending from the detection electrode are connected to a temperature controller.

US6533911. H. Fujita, S. Kitanoya, K. Kato, T. Fuma, R. Inoue, and T. Oshima. Company: NGK Spark Plug Co., Ltd., Aichi, Japan. Issued/Filed: 18 March 2003/9 June 2000.

Engine Blocks

Coating Parent Bore Metal of Engine Blocks. A method of coating adjacent cylinder bore surfaces of an aluminum engine block, the surfaces having a bridge wall separating the bore surfaces and having a preconditioned surface roughness of less than 50 μm Ra, comprising: washing said surfaces with an aqueous solution of nonetching alkaline cleaning agent comprising borate, carboxylic acid, and sodium gluconate, said agent being effective to increase and make homogeneous the surface energy of said preconditioned surface, after drying said surfaces, electrostatically applying a dry dehumidified noncorrosive brazing flux that clings to said wash surfaces in a uniform coating thickness in the range 5-100 μm, thermally spraying said adjacent bore surfaces at the same time with a bonding metal to simultaneously (1) thermally activate said electrostatically deposited dry flux to strip said surfaces of oxides and (2) metallurgically adhere said bonding metal to the stripped surfaces, thermally spraying a top metal coat over said bonding metal in each bore to metallurgically adhere thereto said thermal spraying utilizing propulsion and atomizing air that is pumped through said bores to cool said block and avoid excessive engine block heating, particularly at the bridge walls between said adjacent bores, and removing a portion of said top coat to finish said coated surface to 0.1-0.4 μm Ra.

EP0903422B1. D.J. Cook, J.R. Baughman, R.E. Dejack, O.O. Popoola, M.J. Zaluzec, and D.R. Pank. Company: Ford Global Technologies, Inc. Issued/Filed: 8 Jan 2003/31 Dec 1997.

Engine Part

Method of Manufacturing Shoe. A method of manufacturing a shoe according to the present invention comprises a step of cutting a columnar raw material to a given length to provide a disk-shaped raw material, a step of forming on one end face of the disk-shaped raw material a spherical sliding surface that is to be disposed in sliding contact with a spherical surface on a piston, and a step of forming a thermal sprayed layer on the other end face of the disk-shaped raw material by a rapid gas high-velocity oxyfuel (HVOF) spraying process, the thermal sprayed layer serving as a flat plate-shaped sliding surface that is to be disposed in sliding contact with a swash plate. A shoe that is provided with the thermal sprayed layer exhibits an increased seizure resistance in comparison to a conventional shoe that is formed with a sintered layer, and it can be manufactured inexpensively.

US6532664. Y. Kitagawa, S. Muramatsu, M. Akizuki, and H. Asano. Company: Taiho Kogyo Co., Ltd. and Toyota, Japan. Issued/Filed: 18 March 2003/28 Nov 2000.

Glass Deposits

Method for Making Glass by Plasma Deposition and so Obtained Photomask Material. A method of making fused silica includes generating a plasma, delivering reactants comprising a silica precursor into the plasma to produce silica particles, and depositing the silica particles on a deposition surface to form glass.

EP1281680A2 and EP1281679A2. Company: Corning Inc. Issued/Filed: 5 Feb 2003/1 Aug 2002.

Implants

Arrangement and Method for Supplying Implant Fixtures Made Principally of Titanium. In an arrangement and method for supplying implant fixtures made of titanium with surface structures and added bone-growth-stimulating agents or substances, the fixtures are prepared for selective use in different implantation situations. One or more first devices are intended, by means of surface treatments, for example in the form of etching, shot peening, plasma spraying, and/or electrochemical treatment (so-called anodic oxidation), to supply fixtures with different surface structures. One or more second devices are intended to apply calcium phosphate layers in different dose applications onto implant fixtures divided into different ranges (partial ranges), which dose applications create layer thicknesses of the order of 1-3000 nm. In addition, as an alternative or as a complement to this, one or more third devices can be provided to treat implant fixtures belonging to said range, or another range (partial range) which lacks CaP layers, by applying bone-growth-stimulating substance, for example rhBMP-2 or rhBMP-7, in different dose applications with different quantity and strength. A very high degree of selectivity is achieved in this way.

WO03003938A1. J. Hall. Company: Nobel Biocare AB (publ), Göteborg, Sweden. Issued/Filed: 16 Jan 2003/26 June 2002.

Implant, for Example Dental Implant. An implant has one or more surfaces with a basic or starting surface structure derived from mechanical working. A topographic modification of the surface structures is arranged on said surface structure or surface structures. The topographic modification can be formed, for example, by means of shot peening, etching, plasma spraying, chemical action, etc. The topographically modified surface structures support bone-growth-stimulating agent. In a method for producing the implant, three subsidiary methods are used for carrying out the mechanical working, the topographical modification, and the application of the bone-growth-stimulating agent. An important niche in the demand that exists in the field of implants is thus covered in an advantageous manner.

WO03003939A1. J. Hall. Company: Nobel Biocare AB (publ), Göteborg, Sweden. Issued/Filed: 16 Jan 2003/26 June 2002.

Nanosized Powder Manufacture

Method of Manufacturing Fine Particles by Spray Thermal Decomposition Method. To manufacture fine particles of a nanometer-sized oxide, sulfide, silicate, metal, alloy, or these complex having high crystallinity. The method of manufacturing the fine particles by the spray thermal decomposition of a raw material solution is composed of a process for dissolving an inorganic compound except the raw material components, which forms melted liquid drops in the thermal decomposition, into the raw material solution, a process for forming primary particles of an objective material collected inside medium particles composed of the inorganic compound and formed by solidifying, and a process for recovering the fine particles by isolating the primary particles from the medium particles.

JP2003019427A2. K. Okuyama, L. Wuled, and T. Ka. Company: Japan Science & Technology Corp. Issued/Filed: 21 Jan 2003/9 July 2001.

Oil Retention Coating

Connecting Rod with Thermally Sprayed Bearing Layer. In the method for producing a connecting rod eye having a large eye with a cap described in the specification, a microporous aluminum bronze plasma coating is applied to the large eye and the connecting rod eye is then opened by removing the cap, thus breaking the plasma coating. The cap is subsequently remounted and the bearing layer finished by fine spindling, which produces micropores in the bearing surface for oil retention. Circumferential grooves are also provided in the bearing surface to improve oil retention.

US6513238. U. Schlegel. Company: Volkswagen AG, Germany. Issued/Filed: 4 Feb 2003/28 Jan 2000.

Parts Restoration

Article Recovery Method and Apparatus. Method involves providing plasma spraying of powder of equiaxial granular microstructure onto heated article surface to be recovered; performing hot compaction of sprayed layer after heating surface layer of roll, and working surface of article to be recovered at contact zone to temperature providing superplastic state of metal powder, with applied compaction force being selected so as to provide deformation of sprayed metal powder along boundary line of equiaxial metal crystalline grains. Apparatus has plasma burner with feeding hopper for spraying powder onto working surface of article, article rotating mechanism, platform, hot roll, working traverse, plasma burners for preliminary heating of article surface to be recovered, and of hot roll working surface, screen, hanger, quenching cooling nozzle, and active control sensors. Hot roll is connected through hanger to working traverse. Plasma burners are united into block positioned upstream of hot roll contacting zone in direction of rotation thereof on screen fixed to hanger. Quenching cooling nozzles and active control sensors are attached to screen at site downstream of roll contacting zone in direction of rotation thereof. Article rotation mechanism is mounted on platform. Hot roll working surface has profile similar to that of mirror reflection of article surface to be recovered. Method and apparatus may be used for forming protective coat in repair and recovery of parts. Effect: increased strength characteristics of sprayed layer, improved adhesion of sprayed layer with basic metal and reduced power consumption.

RU2199604C2. A.V. Poletaev and I.V. Anisimov. Issued/Filed: 27 Feb 2003/6 April 2001.

Polymer Coatings

Use of Polymer Thermal Spraying

GB0228668A. Company: Scientific Generics Ltd. Issued/Filed: 15 Jan 2003/9 Dec 2002.

Rapid Prototyping

Method and Arrangement for Utilizing a Pseudoalloy Composite for Rapid Prototyping and Low-Volume Production Tool Making by Thermal Spray Form Techniques. Method and arrangement for spray forming an article. The method includes spraying a plurality of metal streams upon a low heat resistant model and thereby forming a spray formed article. Each of the plurality of metal streams is composed of moltenized droplets, and as between the plurality of metal streams, each is composed of different constituent elements. In the spray form process, conditions of the metal streams are controlled, particularly around the time that the droplets land, to prevent adverse affects such as melting or burning the master model. The spray conditions are controlled in such a manner that the individual metal droplets forming the metal streams remain substantially segregate. The segregated state is maintained throughout solidification so that the resulting spray formed article is composed at least partially of pseudoalloy.

US20030034141A1. G. Grinberg, M.M. Shade, D.R. Collins, and R.L. Allor. Issued/Filed: 20 Feb 2003/20 Aug 2001.

Rapid Tooling

Method of Making a Spray Formed Rapid Tool. A method of making a spray formed rapid tool includes the steps of making a model of a desired tool and constructing a ceramic pattern as the inverse of the model. The method also includes the steps of heating the ceramic pattern and thermally spraying a metal material against the ceramic pattern to form a desired tool.

US6513567. D.R. Collins, J.M. Nicholson, J.A. Szuba, K.P. Regan, and R.L. Allor. Company: Ford Global Technologies, Inc., Dearborn, MI. Issued/Filed: 4 Feb 2003/13 Dec 2000.

Restoration of Components

Restoration of Thickness to Load-Bearing Gas Turbine Engine Components. A method for restoring thickness to load-bearing components of gas turbine engines and for repairing a honeycomb structured gas turbine engine component. A surface of the component such as the backing surface of a honeycomb component after honeycomb removal is roughened and cleaned. A selected buildup material is deposited onto the substrate by high velocity oxyfuel deposition or low-pressure plasma spray. The component is heat treated to enhance the bond between the deposited material particles and between the deposited material and the substrate by diffusion.

US20030033702A1. T.F. Berry, M.J. Weimer, D.E. Budinger, D.J. Dietz, M.D. Gorman, and M. Stewart. Issued/Filed: 20 Feb 2003/14 Aug 2001.

Sliding Member

Sliding Member and Method for Manufacture Thereof. A sliding member, characterized in that at least surface portion thereof which forms a sliding face comprises an oxygen-containing alloy (an iron alloy, aluminum alloy or a copper alloy) containing at least one metal element selected from molybdenum and tungsten in an amount of 2-80 wt.% and oxygen in an amount of 0.5-15 wt.%; and a method for manufacturing the sliding member that comprises subjecting an alloy powder to a thermal spraying or a sintering in an oxidizing atmosphere to thereby form the oxygen-containing alloy on the sliding face. The molybdenum or tungsten in the oxygen-containing alloy formed on the sliding face is converted to a sulfide, which functions as a solid lubricant, by the reaction with a sulfur-supplying component contained in a lubricating oil. The solid lubricant reduces the friction coefficient and the exhaustion of a sliding member and thus allows the retention of the low frictional drag and the good resistance to seizure and wear of a sliding member over a long period of time.

WO03000946A1. K. Nakanishi, H. Tachikawa, H. Mori, and T. Oshima. Company: Kabushiki Kaisha Toyota Chuo Kenkyusho, Aichi, Japan. Issued/Filed: 3 Jan 2003/26 June 2002.

Spraying Pipe

Remote Spray Coating of Nuclear Cross-under Piping. A machine that can clean and spray coat the inside of a hollow pipe can contain a support bar and associated motors with a movable carriage that mounts a thermal spray coating device and/or an abrasion cleaning/profiling head where a programmable controller external to the pipe is capable of controlling the motors.

US6508413. J.A. Bauer, G.F. Dailey, M.W. Fischer, D.O. Willaman, and M.J. Metala. Company: Siemens Westinghouse Power Corp., Orlando, FL. Issued/Filed: 21 Jan 2003/30 March 2001.

Tubes

Tube, Method of Coating and Use of Same. This invention concerns tubes for the use at high temperatures or any other aggressive environment. Tubes according to the invention have a coating consisting of a layer of aluminum and aluminum oxide with a thickness of at least 0.3 mm on the outside of the tubes. The coating can consist of many layers and preferably be put on using flame spraying, high-velocity spraying, plasma spraying, or any other thermal spraying technique or a combination of these methods. After the coating has been put on, it is oxidized by heating to ~1050 °C for at least 4 h.

WO03012168A1. J. Olsson. Company: Thermalloys AB, Hallstahammar, Sweden. Issued/Filed: 13 Feb 2003/26 July 2002.

Weapon Barrel

Method of Internally Coating a Weapon Barrel by a Plasma Flame. A method of coating an inner surface of a weapon barrel includes the following steps: introducing a plasma burner into the weapon barrel; producing a plasma flame by the plasma burner; directing the plasma flame against the inner barrel surface to cause impingement thereon; introducing a coating material in powder, wire, or ribbon form into the plasma flame for melting the coating material to form a molten liquid and for depositing the molten liquid by the plasma flame on the inner barrel surface; and moving the plasma burner inside the weapon barrel axially thereof and relative thereto while performing the depositing step for obtaining a surface coating on the inner barrel surface.

US6511710. C. Warnecke. Company: Rheinmetall W & M GmbH, Unterluss, Germany. Issued/Filed: 28 Jan 2003/28 April 2000.

Feedstock

Improved Thermal Spray Powder

EP1276916A2. H. Wallar, R.F. Quinlivan, and S.H. Yu. Company: Saint-Gobain Ceramics and Plastics, Inc. Issued/Filed: 22 Jan 2003/19 April 2001.

Abrasion-Resistant Material

Material and Method for Producing a Corrosion and Abrasion-Resistant Layer by Thermal Spraying

EP1290238A1. E. Lugscheider. Company: Joma Chemical AS. Issued/Filed: 12 March 2003/18 May 2001.

Chromium-Iron Base Alloy

Method for Producing Thermal Spraying Material. To provide a method for producing a chromium-iron base alloy thermal spraying material that has increased pulverizability and has excellent grain shape. A chromium-iron base alloy is subjected to heat treatment and is thereafter subjected to pulverization treatment. The content of chromium in the chromium-iron based alloy is controlled to the range of 60-95 mass%, the grain size thereof is controlled to the range of 1 mm to 5 μm, and the heat treatment is performed in an atmosphere of gaseous hydrogen or inert gas. Further, the pulverization treatment is performed by an impact-type pulverizer.

JP2003027205A2. M. Mori, N. Komabayashi, and H. Morimoto. Company: Showa Denko KK. Issued/Filed: 29 Jan 2003/9 July 2001.

Combustible and Ceramic Materials Combination

Coating a Substrate. A substrate is coated by forming a suspension comprising ceramic particles and particles of a combustible material dispersed in a liquid medium in which the average particle sizes of the combustible and ceramic components are 100:1 to 5:1, the combustible particles having an average particle size of 10 to 500 μm, and the volume proportion of ceramic particles to combustible particles is from 1:100 to 1:5, granulating (e.g., spray drying) the suspension to form composite particles in which the particles of combustible material are coated with the ceramic particles and plasma spraying the composite particles on to the substrate. The composite particles may be subjected to a temperature sufficient to burn out the combustible material before the particles are plasma sprayed. The ceramic particles may be selected from zirconia, yttria-stabilized zirconia, alumina, chromia, magnesia, and mixtures thereof including spinel structures comprising these oxides. The combustible particles may be polymeric, e.g., polyester, nylon, polyimide, or polycarbonate or a readily combustible finely divided organic powder such as walnut shell flour or wood powder. Applications include temperature-resistant coatings on molds for casting metals and on turbine blades for jet engines.

GB2379896A. Y. Sungh. Company: Saint-Gobain Ceramics & Plastics, Inc. Issued/Filed: 26 March 2003/16 Aug 2002.

Dicalcium Silicate

Thermal Spray Powder of Dicalcium Silicate and Coating Thereof and Manufacture Thereof. A powder of dicalcium silicate is made by spray drying calcia and silica with incorporation of sodium and phosphorus or stabilized zirconia. The spray dried powder is sintered to form a thermal spray powder. Sprayed coatings have a web of interconnected, randomly oriented microcracks substantially perpendicular to the coating surface. The coatings are stable in thermal cycling and a hot corrosive environment.

US6524704 and EP1063316A3. X. Wei, M.R. Dorfman, L.F. Correa, F. Jansen, and J. Peters. Company: Sulzer Metco (US) Inc. Issued/Filed: 26 Feb 2003/21 June 2000.

Nanopowders

Nanostructural Raw Materials for Thermic Deposition. Processes for making nanostructural materials used for deposition of nanostructure coating by means of standard installations for thermic deposition. In one variant of invention nanostructural raw material contains spheric agglomerates prepared by secondary treatment of powders. In other variant of invention fine dispersion of nanoparticles is directly injected to torch or plasma in thermic deposition apparatus for applying nanostructural coatings. In next variant of invention liquid metallorganic chemical precursors are directly injected to torch of plasma apparatus for thermic deposition. In the result synthesis of nanoparticles, melting and hardening are realized during one operation. In all variants ultrasound is used for disintegrating particle-synthesized agglomerates, for dispersing nanoparticles in liquid medium, and for spraying liquid precursor. Nanostructural materials with ultrafine grains and particles suitable for thermic deposition are produced.

RU2196846C2. P.R. Stratt, B.Ch. Kir, and R.F. Boulend. The University of Connecticut and Rutgers, The University of New Jersey. Issued/Filed: 20 Jan 2003/13 Nov 1996.

Nonoxide Powder

Nonoxidic Ceramic Coating Powder and Layers Produced Therefrom. The invention involves the fields of ceramics and surface technology and relates to a nonoxidic ceramic coating powder that can, for example, be used for producing layers using methods taken from the thermal spraying process group. The aim of the invention is to provide a nonoxidic ceramic coating powder, which can be processed into layers by using the current methods of the thermal spraying method group (variants of plasma spraying, detonation spraying, high-velocity flame spraying, or HVOF), and to provide layers produced therefrom. To this end, a nonoxidic ceramic coating powder containing, as a main constituent, a carbide or mixtures and/or compounds of carbides and containing, as secondary constituents, compounds comprising aluminum oxides and rare-earth oxides. In addition, a nonoxidic ceramic layer is provided in which carbides or mixtures and/or compounds of carbides are sintered with essentially crystalline aluminum rare-earth oxide compounds serving as secondary phases.

WO03004718A2. J. Adler, L.-M. Berger, J. Ihle, M. Nebelung, P. Vuoristo, and T. Mäntylä. Company: Fraunhofer-Gesellschaft Zur Förderung Der Angewandten Forschung E.V., München, Germany. Issued/Filed: 16 Jan 2003/27 June 2002.

Superalloy Material

Article Having a Superalloy Protective Coating, and its Fabrication. An article protected by a protective coating includes a substrate made of a first nickel-base superalloy substrate material that is susceptible to the formation of a secondary reaction zone when overlaid by a diffusion aluminide coating or an aluminide overlay coating. A protective coating including a deposited coating at the substrate surface. The deposited coating is a second nickel-base superalloy different from the first nickel-base superalloy and that does not produce a secondary reaction zone when interdiffused with the first nickel-base superalloy. In one version, the deposited coating has a nominal composition of about 3.1 wt.% Co, about 7.6 wt.% Cr, about 7.8 wt.% Al, about 5.45 wt.% Ta, about 3.85 wt.% W, about 1.65 wt.% Rh, about 0.02 wt.% C, about 0.016 wt.% Hf, about 0.015 wt.% B, about 0.5 wt.% Si, balance nickel and incidental impurities. A ceramic thermal barrier coating may overlie the protective-coating outer surface.

US20030044634A1. T.J. Kelly and P.K. Wright, Cincinnati, OH. Issued/Filed: 6 March 2003/31 Aug 2001.

W-Cr-Co-Ni Powder

Corrosion Resistant Powder and Coating. The invention is a corrosion-resistant powder useful for deposition through thermal spray devices. The powder consists essentially of 30-60 wt.% W, 27-60 wt.% Cr, 1.5-6 wt.% C, a total of 10-40 wt.% Co plus nickel and incidental impurities plus melting point suppressants.

US6503290. W.J.C. Jarosinski and L.B. Temples. Company: Praxair S.T. Technology, Inc., North Haven, CT. Issued/Filed: 7 Jan 2003/1 March 2002.

Spray Methods

Further Improvements in Thermal Spraying Apparatus

GB0301530A. Company: Quigley Associates. Issued/Filed: 25 Feb 2003/23 Jan 2003.

Bonding Thermal Spray

Method of Bonding a Thermally Sprayed Coating to a Light Metal Surface.

GB2340133B. M.J. Zaluzec, O.O. Popoola, K. Lazarz, and A.M. Joaquin. Company: Ford Global Technologies Inc. Issued/Filed: 12 March 2003/30 July 1999.

Monitoring Spray Processes

Method for Monitoring Plasma or Flame Spray Processes. A method for measuring characteristic properties of a plasma beam in a thermal spraying process, wherein the spraying materials are fed into the plasma and the luminous radiation emitted by the plasma is reproduced on optical fibers. The luminous radiation is reproduced on the one end of the optical fibers arranged in a one-dimensional or two-dimensional array. Spectral analysis of the luminous radiation transmitted in the optical fiber is accomplished with a spectrometer arranged at the other end of an optical fiber. The frequency spectra are analyzed in a processor to determine the contemporaneous condition of the spraying process.

US20030052259A1. E. Bayer, J. Hoschele, S. Schneiderbanger, and J. Steinwandel, Germany. Issued/Filed: 20 March 2003/16 Aug 2002.

Parts with Cooling Holes

Method for Thermal Barrier Coating and a Liner Made Using Said Method. A method of applying a thermal barrier coating system to a metal piece having cooling holes angled in a first direction and cooling holes angled in a second direction. The method includes spraying a bond coat on a first surface of the piece at angles with respect to the first and second directions and to a thickness selected in combination with the angles to prevent the bond coat from entirely filling any of the holes. A thermal barrier coating is sprayed on the bond coat at angles with respect to the first and second directions and to a thickness selected in combination with the angles to prevent the thermal barrier coating from entirely filling any of the holes. The method also includes spraying a high-pressure fluid jet from a nozzle assembly through each hole generally parallel to the respective cooling hole.

US20030010035A1. G. Farmer, T.J. Tomlinson, R.W. Heidorn, J.A. Fehrenbach, W.L. Imhoff, and M.E. Rutherford. Issued/Filed: 16 Jan 2003/13 July 2001.

Platinum-Aluminide Coating

Method for Preparing an Article with a Hafnium-Silicon-Modified Platinum-Aluminide Bond or Environmental Coating. An article such as a gas turbine blade or vane has a superalloy substrate and a coating system deposited on the substrate. The coating system includes a protective layer overlying the substrate, and, optionally, a ceramic thermal barrier coating layer overlying the bond coat. The protective layer has an uppermost layer with a composition including platinum, aluminum, and, ~0.14 to ~2.8 at.% Hf and ~2.7 to ~7.0 at.% Si, with the atomic ratio of silicon:hafnium being from ~1.7:1 to ~5.6:1.

US20030044536A1 and US6514629. J.D. Rigney, R. Darolia, and W.S. Walston. Issued/Filed: 6 March 2003/30 Sept 2002.

Spraying Inner Surfaces of Pipes

Method for Forming Thermal Spray Coating on Inner Surface of Bent Pipe, and Device Therefore. To provide a method for uniformly and efficiently forming a thermal spray coating on the inner surface of a bent pipe, and a device therefore. In the method and the device for forming a thermal spray coating on the inner surface of a bent pipe by inserting a spray head into the bent pipe, the aforementioned spray head is inserted with an upward posture the bent pipe, while being rotated to-and-from in the range of about 180°, and then moving back the spray head with a downward posture in the bent pipe, while being rotated to-and-fro in the range of about 180°, to form the thermal spray coating on the inner surface in the range of 360° of the bent tube. And, by controlling the rotating speed of the spray head slower in the upward pasture than in the downward posture to form the thermal spray coating uniformly in a direction of 360°. In addition, by controlling the aforementioned rotating speed combined with the advancing and retreating speed, to efficiently form the coating.

JP2003013197A2. H. Nishiwaki. Company: Shinwa Kogyo KK. Issued/Filed: 15 Jan 2003/28 June 2001.

Temperature Control During Deposition

Method and Device for Coating High-Temperature Components by Means of Plasma Spraying. The invention relates to a method for coating high-temperature components by means of plasma spraying. An infrared camera is used to determine the distribution of the thermal radiation of the component surface and to determine therefrom the temperature distribution in accordance with which a method parameter is set in order to reach a threshold temperature. The invention also relates to a coating device for producing a coating while monitoring the surface temperature by means of an infrared camera.

US6537605. F. Kirchner, D. Raake, and H. Reymann. Company: Siemens Aktiengesellschaft, Munich, Germany. Issued/Filed: 25 March 2003/20 April 2001.

Temperature Monitoring

Method and Apparatus for Controlling Spray Forming Process Based on Detected Surface Temperature. To retain a thermal gradient in a material in a thermal spraying process to a minimum. As for the subject method and apparatus, an infrared sensor in the form of a two-wavelength imaging pyrometer measuring the surface temperature distribution in a billet made of steel to be spray formed on real time is incorporated into a metal spray forming process. The billet made of steel can be used in an advantageous shape as a die in treatment requiring a firm die in the automobile industry or the like such as a metal molding process, injection molding, and die casting. The billet made steel has a uniform surface temperature distribution and is therefore formed so as to minimize thermal stress produced in a steel product to be produced.

JP2003027207A2. J.R. Baer, K.P. Regan, and R.L. Allor. Company: Ford Motor Co. Issued/Filed: 29 Jan 2003/18 April 2002.

Spray Systems

Air-Stabilized Plasma Spray System

Plasma Spraying Plant. Devices and techniques of coatings application, particularly plants of coatings application by plasma spraying of powder materials to article surfaces. Plasma spraying plant uses air as plasma-formation gas and system of combined supply of plasma-formation gas and sprayed powder is made in the form of combination of holes located round cathode in cathode holder. In addition, located between cathode and anode is metal washer-diaphragm electrically connected with anode. Power source in plant consists of main and auxiliary sources. Plasma spraying plant may be used for application of ceramic, metallic and composite powder materials. Plant possesses sufficient power for producing qualitative coatings. Plasma spraying plant is simple in servicing, does not need presence of gas cylinder equipment and may operate from domestic electric mains, for instance, under conditions of stomatologic polyclinics.

RU2196010C2. I.K. Batrak, G.V. Bol'shakov, and G.P. Soroka. Issued/Filed: 10 Jan 2003/13 April 2001.

Cored Wire Spray System

Thermal Spray Apparatus and Method Having a Wire Electrode with Core of Multiplex Composite Powder; its Method of Manufacture and Use. A thermal spray or welding apparatus including a cored wire electrode with a sheath and a multiplex powder composite. The composite comprises micron-sized particles and submicron-sized particles, including nanoscale particles, the particles mechanically cooperating to promote smooth powder flow, which facilitates compaction of the cored wire electrode. The invention also includes a method of manufacture of the apparatus including the cored wire electrode and its method of use to deposit a low-porosity coating with high levels of alloyed refractory elements that is adherent and low in oxide content.

US6513728. J.P. Hughes and D.J. Urevich. Company: Concept Alloys, L.L.C., Farmington Hills, MI. Issued/Filed: 4 Feb 2003/13 Nov 2000.

Torch Electrode

Method of Coating an Emissive Element. An electrode for a plasma arc torch and method of fabricating the same are disclosed, wherein the electrode comprises a metallic holder defining a cavity in a forward end. An emissive element and separator assembly is positioned in the cavity. The emissive element has a layer of relatively nonemissive material on the outer surface thereof, which is preferably applied by heating the emissive element to a high temperature such that the emissive element becomes reactive, and spraying the relatively nonemissive material on the emissive element. The coated emissive element is positioned in the separator and the assembly is heated such that the relatively nonemissive material forms a strong bond between with the separator. The superior bonds between the emissive element and separator formed according to the present invention extend the life span of the electrode.

US6528753. M.C. McBennett. Company: The ESAB Group, Inc., Florence, SC. Issued/Filed: 4 March 2003/31 May 2001.

Torch Head

Torch Head for Plasma Spraying. A torch head includes a torch body that is inserted into the tube member, a cathode tube that is arranged in the torch body such that the longitudinal axis of the cathode tube is aligned to the longitudinal axis of the torch body and that has a cathode at the distal end of the cathode tube, an anode member that is arranged on the distal end side of the cathode tube, and a spraying material supply tube that opens toward a mouth opening formed in the anode member and that is arranged outside the torch body. In the anode member, a plasma gas supply chamber in which the front end of the cathode tube is stored in a noncontact state, an orifice that communicates with the plasma gas supply chamber and in which the cathode is stored in a noncontact state, and a plasma generation chamber that communicates with the orifice, that has a longitudinal axis substantially perpendicular to the longitudinal axis of the torch body, and that has the mouth opening are formed. The opening area of the orifice when the anode is inserted is made 1/3 to 1/10 the opening areas of the plasma-generation chamber and the mouth opening so that an arc from the distal end of the cathode is generated within a range of 0° to 40° with respect to the longitudinal axis of the plasma generation chamber perpendicular to the longitudinal axis of the cathode.

US20030042232A1 and EP1287898A2. T. Shimazu. Company: Shimazu Kogyo Yugengaisha, Japan. Issued/Filed: 6 March 2003/17 July 2002.

Thermal Barrier Deposits

Low Thermal Conductivity Thermal Barrier Coating System and Method Therefore. A multilayer thermal barrier coating (TBC) having a low thermal conductivity that is maintained or even decreases as a result of a postdeposition high-temperature exposure. The TBC comprises an inner layer and an insulating layer overlying the inner layer. The inner layer is preferably yttria-stabilized zirconia (YSZ), while the insulating layer contains barium strontium aluminosilicate (BSAS). After deposition, the TBC is heated to a temperature and for a duration sufficient to cause a decrease in the thermal conductivity of the BSAS-containing layer and, consequently, the entire TBC.

US20030003318A1. I. Spitsberg and B.A. Nagaraj. Issued/Filed: 2 Jan 2003/15 June 2001.

Process for Applying a Heat Shielding Coating System on a Metallic Substrate. The invention provides a process for applying a heat shielding coating system on a metallic substrate. The coating system comprises at least three individual layers selected from the group of barrier layer, hot gas corrosion protection layer, protection layer, heat barrier layer, and smoothing layer. The coating system is applied to the metallic substrate by low-pressure plasma spraying in a single operation cycle. This process enables the layers to be applied in an arbitrary sequence. The process is preferably used in applying a coating system to a turbine blade, particularly a stator or a rotor blade of a stationary gas turbine or of an aircraft engine, or to another component in a stationary or aircraft turbine that is subjected to hot gas.

US20030008167A1. Michael Loch and Gerard Barbezat. Issued/Filed: 2003-01-09 / 2002-03-21.

Thermal Barrier Coating System of a Turbine Engine Component. A method for forming a thermal barrier coating system on a turbine engine component includes forming a bondcoat on the turbine engine component and depositing a thermal barrier coating so as to overlie the bondcoat. The bondcoat is formed by thermally cospraying first and second distinct alloy powders on the turbine engine component forming an oxidation-resistant region, and thermally spraying a third alloy powder on the oxidation-resistant region to form a bonding region. The oxidation-resistant region is more resistant to oxidation than the bonding region.

US20030008166A1. A.M. Thompson and W.C. Hasz. Issued/Filed: 9 Jan 2003/30 Oct 2001.

Strain-Tolerant Ceramic Coating

EP0916744B1. P. Sahoo and S. Sitko. Company: Sermatech International Inc. Issued/Filed: 22 Jan 2003/16 Nov 1998.

Thermal Barrier Coating Method and Article. An outwardly grown diffusion aluminide bondcoat is formed on a superalloy substrate and has higher concentrations of aluminum and platinum and lower concentrations of harmful impurities (e.g., Mo, W, Cr, Ta, S, etc.) at an outermost region of the bondcoat than at an innermost region thereof adjacent the substrate. The bondcoat is pretreated prior to deposition of a ceramic thermal insulative layer in a manner that reduces grain-boundary ridges on the outermost bondcoat surface without adversely affecting the outermost region thereof, and then is heat treated to thermally grow a stable α-alumina layer on the bondcoat prior to deposition of a ceramic layer.

US20030022012A1. B.M. Warnes, J.L. Cockerill, and J.E. Schilbe. Company: Howmet Research Corp. Issued/Filed: 30 Jan 2003/24 Sept 2002.

Sprayed ZrO_2 Thermal Barrier Coating with Vertical Cracks. A thermal barrier coating system for use on metal alloy components exposed to hostile thermal and chemical environment, such as a gas turbine engine used to generate electricity comprises a thermal barrier layer formed using a dense vertical cracking process and consists of zirconia that is partially stabilized by 1-6 wt.% yttria, preferably less than 4 wt.% yttria and 0-1 wt.% hafnia. The ceramic layer is optimized to protect the underlying superalloy component from erosion, chipping, and handling, while reducing the cost of the protective layer. An alternative method of preparing the thermal barrier coating uses electron beam physical vapor deposition.

EP1281788A1. J.C. Schaeffer and R.W. Bruce. Company: General Electric Co. Issued/Filed: 5 Feb 2003/19 July 2002.

Thermal Barrier Coating. A thermal insulating ceramic layer for use on metal alloy components exposed to hostile thermal and chemical environment, such as a gas turbine engine used to generate electricity. The preferred thermal barrier layer is formed using dense vertical cracking and formed of zirconia that is partially stabilized by yttria in a preferred amount of less than 4 wt.% and about 1 wt.% hafnia. The ceramic layer is optimized to protect the underlying superalloy component from erosion, chipping, and handling, while reducing the cost of the protective layer. An alternative method of preparing the thermal barrier coating uses electron beam physical vapor deposition.

US20030027013A1. J.C. Schaeffer and R.W. Bruce. Issued/Filed: 6 Feb 2003/31 July 2001.

Process for Creating Structured Porosity in Thermal Barrier Coating. A process for creating microgrooves within or adjacent to a TBC layer applied to a gas turbine engine component such as a blade or vane. The process includes the steps of applying a bond coat to the surface of the substrate. A wire mesh is placed a predetermined distance above the bond coat surface. With the wire mesh in position, about 0.002 in. of an inner TBC is applied over the bond coat. The wire in the wire mesh causes a shadow effect as the TBC is applied, so that there are variations in the thickness of the applied TBC, forming microchannels. The wire mesh is removed and an additional outer TBC layer is applied over the inner TBC layer, and the variations in thickness are bridged by the continued deposition of the columnar TBC over the inner TBC layer, forming the microgrooves.

US6528118. C.-P. Lee, R. Darolia, and R.E. Schafrik. Company: General Electric Co., Schenectady, NY. Issued/Filed: 4 March 2003/6 Feb 2001.

Article Protected by a Thermal Barrier Coating System and its Fabrication. An article protected by a thermal barrier coating system is fabricated by providing an article substrate having a substrate surface, thereafter depositing a bond coat on the substrate surface, the bond coat having a bond coat surface, and thereafter processing the bond coat to flatten the bond coat surface. A thermal barrier coating is deposited overlying the bond coat surface. The thermal barrier coating is yttria-stabilized zirconia having an yttria content of from ~3 to ~5 wt.% of the yttria-stabilized zirconia.

US20030044624A1. I. Spitsberg and R.W. Bruce, Loveland, OH. Issued/Filed: 6 March 2003/3 Aug 2001.