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Selected Patents Related to Thermal Spraying

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CA denotes Canadian patent, CN denotes Chinese patent, CZ denotes Czech patent, EP denotes European patent, RU denotes Russian patent, US denotes United States patent, WO denotes World Intellectual Property Organization application. Due to differences in databases, not all data are available for each patent.

The information has the following format: Subject, Full title, Abstract, Patent number, Inventors, Company, Issued/Filed dates.

Applications

Bearing Boss Coating

Method of Producing Spray Deposit on Bearing Boss. Prior to forming a thermal spray coating layer on an end face of a structural base material to be shaped into a boss, firstly an inner masking member is fitted in an original hole of the structural base material, and then an outer masking member is fitted on outer peripheral side of the structural base material. In the next place, by the use of a hard material, a thermal spray coating layer is formed on an annular coating area that is exposed between the inner and outer masking members. Surface areas on the end face of the structural base material, corresponding to an allowance range of a machining operation by which the original hole is ultimately shaped into a joint pin hole of a specified diameter, are left as a noncoating area free of the thermal spray coating layer. Therefore, the original hole in the structural base material can be machined into a final joint pinhole by means of a cutting tool, without experiencing cracking troubles that would otherwise occur to the thermal spray coating layer during the machining operation.

US 6678956. W. Idetsu, R. Suzuki, and O. Gokita. Company: Hitachi Construction Machinery Co., Ltd. Issued/Filed: January 20, 2004/November 30, 2001.

Brazing Agent Coatings

Brazeable Aluminum Material and a Method of Producing Same. A brazeable aluminum material is composed of an aluminum core and a brazing agent layer consisting of a brazing agent thermally sprayed onto and covering a surface of the core. A number of unmolten minute particles of the brazing agent are present in the brazing agent layer, which contains at least an aluminum-silicon alloy and/or a mixture of aluminum and silicon. Characteristic features of a method of producing the brazeable aluminum material are the steps of: preparing a powder composed of minute particles; and thermally spraying the powder onto the aluminum core in such a state that only a surface of each minute particle is molten, with a pith of the particle remaining unmolten. The powder is an aluminum-silicon alloy and/or a mixture of aluminum powder and silicon powder.

CA 2102071. T. Terada, M. Kojima, T. Morita, K. Arakawa, I. Iwai, and M. Furuta. Issued/Filed: February 17, 2004/October 29, 1993.

Coal Pulverizer Shaft Coating

An Improved Strain Relief Main Shaft Assembly. An improved main shaft for a coal pulverizer having a selected portion of the main shaft provided with an intervening material such as a thermally sprayed ceramic coating.

CA 2239571. D.W. Gerber and R.R. Piepho. Company: Babcock & Wilcox. Issued/Filed: January 27, 2004/June 3, 1998

Coatings for Rocket Motor Nozzles

Rocket Motor Nozzle Assemblies Having Vacuum Plasma-Sprayed Refractory Metal Shell Throat Inserts, Methods of Making, and Rocket Motors Including Same. The rocket motor nozzle assembly of this invention includes a throat insert and a carbon or silica protective eyelid. The throat insert has a carbon throat support and a refractory metal shell. The shell is positioned radially inside the throat support to cover the inner surface of the throat support. The protective eyelid covers a sufficient portion of the forward surface region of the shell and the underlying converging portion of the throat support to protect these components against particle impingement. The protective eyelid extends sufficiently far forward along the converging/diverging pathway to cover and protect the forward face or edge of the throat insert and prevent the combustion gases from passing under the throat insert and reaching the radially outer surface of the throat insert. However, the protective eyelid leaves the throat surface region of the shell exposed to the converging/diverging pathway.

US 6711901. A.R. Canfield and J.K. Shigley. Company: Alliant Techsystems Inc. Issued/Filed: March 30, 2004/January 19, 2001.

Composite Coatings for Molten Metal Containers

Coatings for Articles Used with Molten Metal. An improved multilayer coating for use on molten metal holding and transfer apparatus, the coating including a bond layer applied directly to the surface of molten metal holding and transfer apparatus, and a porous layer of ceramic material produced by codeposition of a powder of said ceramic material and a powder of a suitable organic polymer material and, after the codeposition, heating of said polymer material to thermally decompose the polymer material and form the porous layer. The bond layer preferably is formed of a metallic, intermetallic, or composite particulate materials. The metal component may be in the metallic, intermetallic, oxide, clad, or alloyed form consisting of any one or more of the metal components selected from the group of molybdenum, nickel, aluminum, chromium, cobalt, yttrium, and tungsten and may be in combination with yttria, alumina, zirconia, boron, carbon and have a particle size in the range of 5-250 μm, typically 40-125 μm. The bond layer preferably has a thickness of 5-300 μm with a substantially uniform coating layer being provided over the surfaces to have the porous ceramic coat applied.

WO 4002654. M. Jahedi and S. Gulizia. Company: Cast Centre Pty Ltd. Issued/Filed: January 8, 2004/June 30, 2003.

Dental Implant Coatings

Method for Producing Ceramic Coating on Dental Prostheses and Implants Surface. The method involves producing multilayer coating. First, metal layers are applied. The layers are composed of metal identical to one used for manufacturing base. Then, layers from mechanical mixture of metal and ceramics follow, smoothly increasing ceramics content from layer to layer from 20% to 90%. The last one is sprayed ceramic layer. Total plasma sprayed coating thickness is equal to 90-200 μm.

RU 2223066. I.K. Batrak, I.Ja. Aristova, T.N. Grishina, V.A. Ermakov, S.I. Nasikan, G.P. Soroka, and S.V. Shumskaja. Issued/Filed: February 10, 2004/October 14, 2002.

Electrical Contacts

Kinetic Sprayed Electrical Contacts on Conductive Substrates. The present invention is directed to electrical contacts that comprise spaced electrically conductive particles embedded and bonded into the surface of conductors in which the particles have been kinetically sprayed onto the conductors with sufficient energy to form direct mechanical bonds between the particles and the conductors in a preselected location and particle number density that promotes high surface-to-surface contact and reduced contact resistance between the conductors.

US 6685988. T.H. Van Steenkiste, G.A. Drew, D.W. Gorkiewicz, and B.A. Gillispie. Company: Delphi Technologies, Inc. Issued/Filed: February 3, 2004/October 9, 2001.

Electric Insulation Coatings

Method for Producing a High-Quality Insulation of Electric Conductors or Conductor Bundles of Rotating Electric Machines by Means of Thermal Spraying. The process according to the invention discloses production of a high-quality insulation for conductors or conductor bundles. In this process, internal corona-discharge protection, insulation, and external corona-discharge protection are all applied to the conductor or conductor bundle in successive steps by means of thermal spraying. The application thickness per spraying run is up to 0.2 mm, thus ensuring that the layer is free of defects and therefore avoiding partial discharges. Moreover, the ability to withstand thermal loads is considerably improved by the use of high-temperature plastics with fillers comprising inorganic materials as coating powder.

EP 1254501. T. Baumann and R. Fried. Company: Alstom. Issued/Filed: February 4, 2004/December 21, 2000.

Glass Mold

Method and Device for Producing a Blank Mold from Synthetic Quartz Glass by Using a Plasma-Assisted Deposition Method. The invention relates to a method for producing a blank mold from synthetic quartz glass by using a plasma-assisted deposition method, according to which a hydrogen-free media flow containing a glass starting material and a carrier gas is fed to a multinozzle deposition burner. The glass starting material is introduced into a plasma zone by the deposition burner and is oxidized therein while forming SiO_2 particles, and the SiO_2 particles are deposited on a deposition surface while being directly vitrified. In order to increase the deposition efficiency, the invention provides that the deposition burner focuses the media flow toward the plasma zone. A multinozzle plasma burner, which is suited for carrying out the method and which is provided with a media nozzle for feeding a media flow to the plasma zone, is characterized in that the media nozzle is designed so that it is focused toward the plasma zone. The focusing is effected by a tapering of the media nozzle.

WO 4005206. R. Schmidt and K. Brauer. Company: Heraeus Tenevo AG. Issued/Filed: January 15, 2004/July 7, 2003.

Golf Club Coating

Golf Club with Stress-Specific Striking Face and Method of Producing the Coating. In order to increase the useful life of a golf club, at least part of the golf club in a region of the striking face is coated with a coating that is neutral in terms of stress or has compressive stresses. The coating is applied by a thermal spraying method with average spray-particle velocities of more than 500 m/s. The coating preferably has compressive stresses of between 0 and 600 MPa.

US 6679788. P. Heinrich and H. Kreye. Company: Linde Gas AG. Issued/Filed: January 20, 2004/June 26, 2000.

Lightweight FGM Armor

Lightweight Armor System and Process for Producing the Same. A lightweight armor system may comprise a substrate having a graded metal matrix composite layer formed thereon by thermal spray deposition. The graded metal-matrix composite layer comprises an increasing volume fraction of ceramic particles embedded in a decreasing volume fraction of a metal matrix as a function of a thickness of the graded metal-matrix composite layer. A ceramic impact layer is affixed to the graded metal-matrix composite layer.

US 6679157. H.S. Chu, H.A. Bruck, G.C. Strempek, Jr., and D.J. Varacalle. Company: Bechtel BWXT Idaho LLC. Issued/Filed: January 20, 2004/January 18, 2002.

Metallic Corrosion-Resistant Coatings

Corrosion-Resistant Coatings for Steel Tubes. A method of providing a protective, corrosion-resistant thin coating of a MCrX alloy on a carbon or low-alloy steel pipe or tube where M is one of nickel, cobalt, or iron or combination thereof, and X is one of molybdenum, silicon, tungsten, or combination thereof, and heat treating the coating to metallurgically bond the coating onto a steel substrate of the pipe or tube. The coating may be deposited in one or two layers by plasma transferred arc deposition or may be deposited as a slurry coating or thermal spray coating with sintering of the coating. The steel substrate is prepared for coating by at least one of boring, honing, bright finishing, grit blasting, grinding, chemical pickling, or electropolishing of the substrate.

WO 4003251. C.G. Subramanian, D.A. Easton, K.K. Tzatzov, A.S. Gorodetsky, and A.G. Wysiekierski. Company: Bodycote Metallurgical Coatings Ltd. Issued/Filed: January 8, 2004/June 25, 2003.

Metallic Interlayers for Carbon Substrates

A Method for Coating a Carbon Substrate or a Nonmetallic Substrate Containing Carbon. To provide a substrate consisting of carbon or nonmetallic materials containing carbon with a layer of a metal having a high melting point, first an undercoat layer is applied to the substrate by plasma spraying in an inert atmosphere. The undercoat layer predominantly consists of rhenium, molybdenum, zirconium, titanium, chrome, niobium, tantalum, hafnium, vanadium, platinum, rhodium, or iridium. Onto that undercoat layer, a covering layer can be applied, by plasma spraying as well. In order to reduce the thermomechanical stress and to improve the adhesion of the undercoat layer on the surface of the substrate, the substrate is preheated prior to applying the undercoat layer. By means of such a method, carbon-containing substrates can be provided with an undercoat layer and, if required, with a covering layer quickly and reliably at low cost.

CA 2220420. A. Salito. Company: Sulzer Metco AG. Issued/Filed: January 20, 2004/November 30, 1997.

Metal Oxide Catalysts

Direct Application of Catalysts to Substrates for Treatment of the Atmosphere. A method for direct application of a cata-

lyst to a substrate for treatment of atmospheric pollution including ozone. The method includes applying a catalytic metal to a substrate utilizing a kinetic spray process. The process can be utilized to apply a base metal such as copper to a substrate, and the base metal becomes the catalytically active oxide following application to the substrate. This system replaces a multistep process with a single-step process to provide a catalytically active surface that can be utilized to reduce ground level ozone and other atmospheric pollutants.

US 6682774. J.R. Smith, M.F. Sultan, M.-C. Wu, and Z. Zhao. Company: Delphi Technologies, Inc. Issued/Filed: January 27, 2004/June 7, 2002.

Niobium-Base Corrosion-Resistant Coatings

Niobium-Base Compositions and Coatings, Niobium Oxides, and Their Alloys Applied by Thermal Spraying and Their Use As an Anticorrosive. The novelty proposed herein describes the application of niobium-base compositions and coatings, niobium oxides, and their alloys capable of associations with other oxides and alloys by means of the thermal spraying technique for the purpose of an anticorrosive protection in highly corrosive environments, mainly those that present high temperatures, show presence of gases such as H_2S, SO_2, CO_2, as well as organic and inorganic acids, commonly found in industrial centers.

WO 4022806. L.R.M. Miranda, L.J. Carvalho, and A.C.G. Pereira. Company: Universidade Federal do Rio de Janeiro. Issued/Filed: March 18, 2004/November 13, 2002.

Piston Ring Coatings

Process of Thermally Spraying Coatings. The present invention relates to a method including thermal spraying a chromium nitride or a chromium carbide and chromium silicide coating material onto an article, such as a piston ring. The coating material may be in a powder form before thermal spraying. In one aspect, the thermal spraying includes melting the coating material, propelling the molten coating material toward the article to be coated, and coating the article with the molten coating material.

WO 4018728. T. Stong, T.J. Smith, P.J. Einberger, and P.A. Whyman. Company: Dana Corp. Issued/Filed: March 4, 2004/August, 20, 2003.

Polymer Sealing Coating

Sealer Coating for Use on Porous Layers. A die or mold coating comprising: a bond layer and a porous layer of ceramic material produced by codeposition and heating of said ceramic material and a powder of an organic thermosetting polymer material; and an upper sealer coating comprising metal or ceramic filler particles dispersed in a carrier.

WO 4002655. S. Gulizia and M. Jahedi. Company: Cast Centre Pty Ltd. Issued/Filed: January 8, 2004/June 30, 2003

Porous Coatings for Heat Exchangers

Heat Exchanger Tube, and Method for the Production of Same. In order to provide a heat pipe for transporting heat from an evaporation area to a condensation area, comprising a housing with housing walls, a capillary structure arranged in the housing and thermally coupled to the respective, corresponding housing wall in the evaporation area as well as in the condensation area, a vapor channel arranged in the housing and leading from the evaporation area to the condensation area as well as a heat transport medium, as well to make available a process for the production of such a heat pipe it is suggested that the capillary structure be an open-pored capillary layer produced by way of thermal plasma spraying of powder particles.

CA 2250415. D. Laing, R. Henne, and H. Thaler. Company: Deutsches Zentrum fur Luft- und Raumfahrt E.V. Issued/Filed: March 9, 2004/January 21, 1998.

Wear-Resistant Cold Sprayed Coatings

Mixed Powder Deposition of Components for Wear-, Erosion-, and Abrasion-Resistant Applications. An abrasive coating and a process for forming the abrasive coating by codepositing hard particles within a matrix material onto a substrate using a cold spray process. The cold sprayed combination of hard particles and matrix material provides a coating that is wear-, erosion-, and oxidation-resistant. The abrasive coating may have different compositions across its depth. The hard particles may be deposited at different densities across the thickness of the matrix material. A first layer of the abrasive coating proximate the surface of the substrate may be devoid of hard particles.

US 6706319. B.B. Seth and G.P. Wagner. Company: Siemens Westinghouse Power Corp. Issued/Filed: March 16, 2004/July 26, 2002.

Zinc Coatings for Heat Exchangers

Method for Production of Heat Exchanger. A heat exchanger, characterized in that aluminum or aluminum alloy tubes, each having a thermally zinc sprayed layer formed on the surface of it, and having a brazing filler metal layer formed on said thermally zinc sprayed layer using a powdery brazing filler aluminum alloy composed of 5-60 wt.% Si and the balance of Al and unavoidable impurities, are combined with and brazed to an aluminum or aluminum alloy header having a brazing filler metal layer formed using a powdery brazing filler aluminum alloy composed of 5-60 wt.% Si and the balance of aluminum and unavoidable impurities. The tubes and the header are strongly bonded to each other, and zinc is uniformly diffused and distributed. So, the heat exchanger shows good corrosion resistance.

US 6708869. Y. Hyogo, A. Watanabe, and K. Tohma. Company: Mitsubishi Aluminum Kabushiki Kaisha. Issued/Filed: March 23, 2004/August 14, 2002.

Feedstock

Composite Powder for Turbine Seals

Thermal Spray Powder of Oxidized Polyarylene Incorporating a Particular High-Temperature Polymer. Powders of oxidized polyarylene sulfide and powders comprising from 1-99 wt.% of oxidized polyarylene sulfide and from 1-99 wt.% of a metal, carbide, ceramic, or high-temperature polyimide, polyamide imide, polyester imide, and aromatic polyester plastic, or a mixture thereof are very suitable for use in thermal spraying and thereby form coatings having a strong chemical and mechanical resistance and high-dimensional stability when exposed to high and low temperatures. Such coatings are advantageous for use as abradable seal clearance control coating in the compressor section of gas turbine engines, motor vehicle turbochargers, and superchargers, and for use as a coating of reaction vessels, kitchen ware, sealings or bearings.

US 6682812. H. Scheckenbach and C.W. Smith. Company: Ticona GmbH. Issued/Filed: January 27, 2004/January 2, 2002.

Cored Wire with Composite Powder

Wire Electrode with Core of Multiplex Composite Powder, Its Method of Manufacture and Use. A cored wire electrode with a sheath and a multiplex powder composite for use in a thermal spray or welding apparatus. The composite com-

prises 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 cored wire electrode and its method of use.

US 6674047. J.P. Hughes and D.J. Urevich. Company: Concept Alloys, L.L.C. Issued/Filed: January 6, 2004/November 13, 2000.

Nanocomposite Ceramic Powder

Spherical Nanocomposite Powder and a Method of Preparing the Same. The present invention provides a composition and method of producing nanocomposite powder consisting essentially of hydroxyapatite (HA) and zirconium oxide (ZrO_2). The method comprises the steps of reacting orthophosphoric acid with calcium hydroxide to form a HA suspension, adding ZrO_2 suspension to the HA suspension to form a composite feedstock, and subjecting the composite feedstock to radio frequency (RF) plasma spraying to form the nanocomposite powder. Quantity of the zirconium oxide suspension added is in the range of 10-40 wt.% of the composite feedstock. The nanocomposite powder comprises 60-90 wt.% calcium hydroxyapatite, 10-40 wt.% zirconium oxide, and traces of calcium phosphate.

WO 4011050. P.C.H. Ning, R. Kumar, N. Kasinath, and A.K. Khiam. Company: Nanyang Technological University. Issued/Filed: February 5, 2004/July 30, 2003.

Nanosized Stabilized Zirconia Powder

Process for Making Nanosized Stabilized Zirconia. A process to produce stabilized zirconia from a solution of zirconium salt and a stabilizing agent. The zirconium salt may include zirconium oxysulfate, zirconium oxychloride, zirconium oxynitrate, zirconium nitrate, and other water-soluble zirconium salts. The stabilizing agent may include calcium, magnesium, yttrium salts of oxides and rare earth oxides. The process is conducted by evaporation of the solution above the boiling point of the solution but below the temperature where there is significant crystal growth. The evaporation step is followed by calcination to produce the desired nano-sized structure. Further processing by sintering may be applied to produce solid structures or by milling and classification to produce material for thermal spray coating.

WO 3076337. B.J. Sabacky and T.M. Spitler. Company: Altair Nanomaterials Inc. Issued/Filed: 2004-02-12/2002-10-16.

Nickel Alloy Powder or Wire

Nickel-Base Material in Powder- or Wire Form for Coating as well as the Processes Thereof. A nickel-base powder or wire material, for thermal deposition of highly corrosion- and wear-resistant coatings, has the composition (by wt.%) 0.005-1.0% C, 10-26% Cr, 8-20% Mo, 0.1-10% Fe, 3-7% Si, 1-4% B, 0.1-5.0% Cu, and balance Ni. Preferably, the material has the composition 0.01-0.5 (especially 0.05-0.3)% C, 14-20 (especially 15-18)% Cr, 10-18 (especially 12-16)% Mo, 0.5-5.0 (especially 2-4)% Fe, 4.0-6.5 (especially 4.5-5.5)% Si, 1.5-3.5 (especially 2-3)% B, 1-4 (especially 2-3)% Cu and balance Ni. The powder may be mixed with a Ni-B-Si powder and/or a Ni-Cr-B-Si powder. Also claimed are (a) methods of thermally depositing the above material to produce a corrosion- and wear-resistant coating on a workpiece, in which (i) the coating material powder is an alloyed and atomized material or an agglomerate of various alloyed and unalloyed metal powders and (ii) the coating material is used in the form of a filled wire or an alloyed and cast rod and (b) a method of depositing the above material, especially using method (i) or (ii), by thermal spraying, especially plasma powder weld deposition, flame spraying with subsequent remelting, high-velocity flame spraying, two-wire arc spraying or arc weld deposition.

EP 818549. G.R. Heath, P. Heimgartner, and I. Kretschmer. Company: Castolin S.A. Issued/Filed: February 4, 2004/June 6, 1997.

Ni-Cr-C Composite Powder

Powder of Chromium Carbide and Nickel Chromium. A thermal spray powder consists of nickel, chromium, and carbon. The chromium consists of a first portion and a second portion, the nickel being alloyed with the first portion in an alloy matrix. The second portion and the carbon are combined into chromium carbide substantially as Cr_3C_2 or Cr_7C_3 or a combination thereof, with the chromium carbide being in the form of precipitates between 0.1 and 5 μm distributed uniformly in the alloy matrix.

CA 2269146. R.E.. Somoske, Jr., M.R. Dorfman, and K. Laul. Company: Sulzer Metco (US) Inc. Issued/Filed: February 24, 2004/April 16, 1999.

Olivine Powder

Spray Material for Plasma Spraying. In the present invention, there is disclosed a spray material for plasma spraying, particularly using a plasma torch with a gas or water stabilization of the electric arc and intended for metallic and nonmetallic substrates and for manufacture of self-supporting elements by plasma spraying. The invented spray material is formed by particles of natural olivine containing 49-50 wt.% MgO, 41.5-42.5 wt.% SiO_2, 6.8-7.3 wt.% Fe_2O_3, 0.2-0.3 wt.% Cr_2O_3, 0.4-0.5 wt.% Al_2O_3, 0.3-0.35 wt.% NiO, 0.05-0.1 wt.% MnO, 0.05-0.1 wt.% CaO with granulometry ranging within 0.01-0.315. After passage through a plasma stream, the material contains spheroid particles with granulometry in the range of 0.01-0.315 mm.

CZ 293102. K. Neufuss and P. Rohan. Company: Institute of Plasma Physics ASCR. Issued/Filed: February 18, 2004/December 20, 2001.

Rare Earth Fluoride Powder

Method for Formation of Thermal Spray Coating Layer of Rare Earth Fluoride. The invention discloses a material and an efficient method for the formation of a thermal-spray coating layer of a rare earth fluoride by a process of thermal-spray coating by using a unique thermal spray powder consisting of granules of the rare earth fluoride having a specified average particle diameter. The thermal-spray granules are prepared by granulating primary particles of the rare earth fluoride having a specified average particle diameter from an aqueous slurry containing a binder resin and subjecting the granules to a calcination treatment at a temperature not higher than 600 °C.

US 6685991. K. Wataya and T. Maeda. Company: Shin-Etsu Chemical Co., Ltd. Issued/Filed: February 3, 2004/July 31, 2001.

Spherical YSZ Powder

Plasma Spheroidized Ceramic Powder. Thermal spray powders suitable for application of a thermal barrier coating on a substrate can be obtained by plasma spraying a chemically homogeneous zirconia stabilized in the tetragonal form using a stabilizing oxide such as yttria to obtain a powder comprising substantially spherical hollow zircon a particles with sizes less than about 200 μm.

WO 4015158. H. Wallar. Company: Saint-Gobain Ceramics & Plastics, Inc. Issued/Filed: February 19, 2004/August 4, 2003.

Spraying Methods, Pretreatment and Posttreatment

Masking Tape

Plasma Spray Masking Tape. A masking tape for use in masking a part in a high-velocity oxyfuel (HVOF) plasma spray process. The tape is formed from a fabric that is tightly woven from yarns of aramid fibers. A silicone rubber impregnates the inner fabric layer. First and second silicone rubber layers are coated onto opposite sides of the impregnated fabric. A pressure-sensitive adhesive is coated onto the second silicone rubber layer, which is preferably laminated with a release liner.

CA 2146441. E.V. Yankus and R.F. Hamilton. Company: Allied Signal Inc. Issued/Filed: March 30, 2004/October 21, 1993.

Nanocomposite Coating Formation

Articles with Nanocomposite Coatings. A method of producing a nanocomposite coating without gaseous precursor reactants. A non-nanocrystalline particulate containing a polymorphic material in an atmospheric phase is introduced into a high-velocity gas jet. The projected particulate is allowed to impact a substrate at a velocity effective to cause at a least a portion of the polymorphic material to transform to a nanocrystalline, high-pressure phase.

US 6689453. R. Goswami, S. Sampath, J. Parise, and H. Herman. Company: Research Foundation of State University of New York. Issued/Filed: February 10, 2004/April 1, 2002.

Posttreatment for Porosity Control

Method for Controlling Size and Number of Pores of Self-Supporting Ceramic or Metal-Ceramic Bodies. The invented method for controlling size and number of pores of self-supporting ceramic and/or metal-ceramic bodies made of oxide ceramics, in particular of aluminum oxide (Al_2O_3), titanium dioxide (TiO_2), zirconia (ZrO_2), chromic oxide (Cr_2O_3), magnesium oxide (MgO), yttrium oxide (Y_2O_3), cerium dioxide (CeO_2), calcium oxide (CaO), zirconium silicate ($ZrO_2 \cdot SiO_2$), calcium silicate ($CaO \cdot SiO_2$), and in the metal-ceramic bodies also of a metal being selected particularly from the group consisting of tin (Sn), zinc (Zn), aluminum (Al), nickel (Ni), cobalt (Co), iron (Fe), chromium (Cr), molybdenum (Mo), tungsten (W), or alloys thereof, by plasma spraying is characterized in that pores in the finished self-supporting bodies are additionally partially or completely removed by filling.

CZ 293073. K. Neufuss and P. Chraska. Company: Institute of Plasma Physics ASCR. Issued/Filed: February 18, 2004/September 30, 1996.

Method for Controlling Size and Number of Pores of Self-Supporting Metal-Ceramic Bodies. The invented method for controlling size and number of pores of self-supporting metal-ceramic bodies made of oxide ceramics, in particular of aluminum oxide (Al_2O_3), titanium dioxide (TiO_2), zirconia (ZrO_2), chromic oxide (Cr_2O_3), magnesium oxide (MgO), yttrium oxide (Y_2O_3), cerium dioxide (CeO_2), calcium oxide (CaO), zirconium silicate ($ZrO_2 \cdot SiO_2$), calcium silicate ($CaO \cdot SiO_2$), and a metal being selected particularly from the group consisting of tin (Sn), zinc (Zn), aluminum (Al), nickel (Ni), cobalt (Co), iron (Fe), chromium (Cr), molybdenum (Mo), tungsten (W), or alloys thereof, by plasma spraying is characterized in that pores in the finished self-supporting bodies are additionally increased or reduced by annealing of said self-supporting bodies or by partial or complete removal of the metallic component, preferably by leaching, dissolution or extraction.

CZ 293072. K. Neufuss and P. Chraska. Company: Institute of Plasma Physics ASCR. Issued/Filed: February 18, 2004/September 30, 1996.

Shape Correction

Method and Arrangement for Changing the Shape of Thin-Shell Articles Manufactured by Spray-Form Techniques. The present invention discloses a method of correcting the shape of a spray-formed article that has a concave bowing relative to the working surface of the article. Specifically, deviations of such articles from a desired predetermined shape are corrected by applying sufficient heat to a nonworking surface to permanently remove at least a partial amount of the concave bowing while leaving the working surface substantially unmarred. This process is repeated iteratively until the article achieves the predetermined shape.

US 6675625. A.D. Roche and S. Subramaniam. Company: Ford Motor Co. Issued/Filed: January 13, 2004/November 11, 2002.

Spraying onto Rotor Blades

Thermal Spray Coating Process for Rotor Blade Tips. A process for controllably applying thermal spray coating onto substrates is described. The process includes positioning rotor blades in a fixture rotatable about an axis, forming a spray of particles of softened coating medium in an apparatus for propelling the coating medium toward the blade tips and coating the blade tips by passing the blades through the spray of particles of coating medium. Various process details, including process parameters, are developed.

EP 926255. P.H. Zajchowski, A. Diaz, M. Freling, and J.F. Lally. Company: United Technologies Corp. Issued/Filed: March 3, 2004/December 21, 1998.

Surface Preparation

Surface Preparation Process for Deposition of Ceramic Coating. A method of preparing a superalloy component to receive a ceramic thermal barrier coating without an intermediate bond coat is disclosed. The superalloy substrate is degreased, abrasively cleaned, ultrasonically cleaned, washed in an aqueous bath containing a wetting agent, rinsed at least once, and then heat treated in an atmosphere that is nonreactive with the substrate and alumina at a temperature and time sufficient to form a surface alumina layer that is predominantly alumina.

EP 969122. R.P. Ristau, S. Bose, and A.D. Cetel. Company: United Technologies Corp. Issued/Filed: January 28, 2004/June 11, 1999.

Spraying Systems

Arc Control System

Arc Control for Spraying. A thermal spraying system includes thermal spray material, an electrical energy thermal spraying device atomizing and spraying the thermal spray material, a power supply supplying electrical power to the spraying device, a sensor monitoring a power characteristic of the supplied electrical power, and a feed-rate control module adjusting a feed rate of the thermal spray material based on the monitored power characteristic.

US 6703579. E.E. Rice. Company: Cinetic Automation Corp. Issued/Filed: March 9, 2004/September 30, 2002.

Hot Gas Supply

Production of Hot Gas for Thermal Spraying. Method and apparatus for production of heated gas during thermal spraying. A gas supplied from a pressure vessel for thermal spraying in combination with an additional material in powder

form is heated after it leaves a buffer tank located after the pressure vessel.

EP 924315. P. Heinrich, H. Meinass, and I. Kreye. Company: Linde AG. Issued/Filed: March 10, 2004/December 11, 1998.

Melting + Spraying System

Integrated Melting-Spraying Equipment and Technology. The present invention relates to an integrated melting-spraying equipment and its process. It mainly consists of main power supply, auxiliary power supply, cooling system, working gas system, control system, and melting-spraying gun that adopts double-arc structure form. The various parameters of powder-feeding rate, plasma arc temperature, pressure and melting-spraying speed of said equipment can be regulated, then said equipment can be used for melting and spraying workpiece to make the coating layer and base material can be molten integrally. Said invention can be used for surface modification of mechanical equipment, repairing waste and old product, and also for manufacturing some new products.

CN 1465737. M. Guo and Y. Zhang. Issued/Filed: January 7, 2004/June 28, 2002.

Modular Plasma Spray Gun

Plasma Spray Device. This device has a focal shank and a jet tip for fastening to it with a plasma jet radiating from it. The jet tip is fixed on the focal shank by contact elements for transferring current that jut out toward the front side of the jet tip. Quick gripping levers fitted on the focal shank tighten the jet tip and their cams are set to mesh into recesses in the contact elements.

EP 1065914. M. Muller and C. Marki. Company: Sulzer Metco AG. Issued/Filed: January 21, 2004/May 3, 2000.

Plasma Spraying Apparatus. A plasma spraying apparatus is provided comprising a plasma gun shaft member and a plasma gun head member, connected to the plasma gun shaft member and adapted to create a plasma torch escaping radially from the head member. In order to enable the plasma gun head member and, thereby, those parts and elements thereof that are subject to wear quickly and easily, the plasma gun head member is of modular design. For fixing the plasma gun head member to the plasma gun shaft member, the electrical contact elements provided for transmitting electrical power on the plasma gun head member are used. These electrical contact elements tower above that front face of the plasma gun head member that is intended to be connected to the plasma gun shaft member. Clamping the head member to the shaft member is accomplished by means of quick release lever members provided on the shaft member. That lever members are provided with eccentric portions engaging recesses provided on the electrical contact elements.

CA 2311088. C. Marki and M. Muller. Company: Sulzer Metco AG. Issued/Filed: January 20, 2004/June 9, 2000.

Plasma Spray Gun

Plasmatron for Spraying of Coatings. The claimed device relates to design of electric arc plasmatrons for spraying of coatings and can find application in various industries for deposition of wear- and corrosion- and heat-resistant, bioceramic, decorative and other types of coatings. Plasmatron for spraying of coatings using a laminar plasma jet comprises the insulating casing that houses a cathode unit consisting of a rod cathode and nozzle part composed of the nozzle for formation of the plasma jet and nozzle for feeding of the shielding gas installed coaxially at the cathode unit through the insulating sleeve and insulator, the cathode unit being connected to the service unit that includes the water-supplying casing, gas-supplying casing, and current-conducting elements, and an external anode unit consisting of a casing and water-cooled anode. The external anode unit is L-shaped and installed with the possibility of being moved along the cathode axis and the possibility of being turned about this axis, the anode of the external anode unit and nozzle for formation of the plasma jet of the cathode unit being made removable. The claimed device provides the possibility of varying the arc voltage, including directly during operation, improving operational reliability and making maintenance of the plasmatron more convenient, owing to modification of design of the anode and cathode units.

WO 4010747. K. Yushchenko, Y. Borysov, S. Voynarovich, and O. Fomakin. Company: International Association INTERM. Issued/Filed: January 29, 2004/April 25, 2003.

Spray Gun Gas Cap and Nozzle

Thermal Spray Gun with Inner Passage Liner and Component for Such Gun. A gas cap for a thermal spray gun has a spray passage extending from the combustion chamber to an exit end, and a thermal spray material is fed into the passage. A nozzle component of the gas cap is formed of a tubular inner member in thermal contact with a metallic outer member, such as copper, that is in contact with a fluid coolant. The inner member is formed of a hard, thermally conductive material, preferably a carbide in a metal matrix, such as tungsten carbide in cobalt.

CA 2205681. W.P Rusch. Company: Sulzer Metco (US) Inc. Issued/Filed: January 20, 2004/May 16, 1997.

Spray Gun for Small Bores

Small Bore PTWA Thermal Spraygun. The present invention provides a plasma transferred wire arc (PTWA) torch assembly that includes a monolithic block assembly that combines into a single component several features that have previously been separate components. The monolithic block of the present invention combines the functions of a wire guide, an air baffle, and a nozzle. Integration of these components allows for a reduction in size of the plasma transferred wire arc torch assembly, thereby making it possible to coat smaller diameter bores with metal.

US 6706993. J.E. Chancey, L.E. Ellis, L.G. Gargol, and S.C. Reddy. Company: Ford Motor Co.. Issued/Filed: March 16, 2004/December 19, 2002.

Wire Plasma Spraying

Method and Device for Thermal Spraying for the Coating of Surfaces. The method for thermal spraying, especially of metals, for the coating of surfaces, wherein the material employed for coating is supplied in the form of a wire, molten and sprayed, uses a plasma arc.

US 6680085. D. Kley. Company: Grillo-Werke AG. Issued/Filed: January 20, 2004/January 9, 2003.

Thermal Barrier Coatings and Bond Coats

Insulating of Furnace Rolls. An insulating roll is provided that is constructed with a roll body formed of a plurality of inorganic material-derived discs laminated with each other and positioned axially of and around a metal conduit, and a heat-resistant metal tube disposed integrally over an outer periphery of the roll body. The discs do not consist of metal. A tubular cover formed by spray coating a

ceramic material on the heat-resistant metal tube, or a sintered ceramics-made sleeve may be disposed, where desired, in place of the heat-resistant metal tube. This roll has low thermal conductivity and high impact strength without involving reduced surface temperature of a material being heat treated in a furnace, or reduced ambient temperature in the furnace during heat treatment.

EP 890808. K. Hiraguri and T. Yokomizo. Company: Ask Technica Corp. Issued/Filed: January 28, 2004/July 6, 1998.

In Situ Formation of Multiphase Deposited Thermal Barrier Coatings. A multiphase ceramic thermal barrier coating is provided. The coating is adapted for use in high-temperature applications in excess of about 1200 °C, for coating superalloy components of a combustion turbine engine. The coating comprises a ceramic single- or two-oxide base layer disposed on the substrate surface; and a ceramic oxide reaction product material disposed on the base layer, the reaction product comprising the reaction product of the base layer with a ceramic single- or two-oxide overlay layer.

US 6677064. R. Subramanian. Company: Siemens Westinghouse Power Corp. Issued/Filed: January 13, 2004/May 29, 2002.

Nickel Aluminide Coating and Coating Systems Formed Therewith. A protective overlay coating for articles used in hostile thermal environments and particularly for use as a bond coat for a thermal barrier coating deposited on the coating. The coating is predominantly beta-phase NiAl into which a platinum-group metal is incorporated, yielding a coating system capable of exhibiting improved spallation resistance as compared to prior bond coat materials containing platinum, must notably the platinum aluminide diffusion coatings. A preferred composition for the beta-phase NiAl overlay coating further contains chromium and zirconium or hafnium.

US 6682827. R. Darolia, J.D. Rigney, and J.A. Pfaendtner. Company: General Electric Co. Issued/Filed: January 27, 2004/December 20, 2001.

Segmented Thermal Barrier Coating and Method of Manufacturing the Same. A thermal barrier coating having a less dense bottom layer and a more dense top layer with a plurality of segmentation gaps formed in the top layer to provide thermal strain relief. The top layer may be at least 95% of the theoretical density in order to minimize the densification effect during long-term operation, and the bottom layer may be no more than 95% of the theoretical density in order to optimize the thermal insulation and strain tolerance properties of the coating. The gaps are formed by a laser-engraving process controlled to limit the size of the surface opening to no more than 50 μm in order to limit the aerodynamic impact of the gaps for combustion turbine applications. The laser-engraving process is also controlled to form a generally U-shaped bottom geometry in the gaps in order to minimize the stress concentration effect.

US 6703137. R. Subramanian. Company: Siemens Westinghouse Power Corp. Issued/Filed: March 9, 2004/August 2, 2001.