Selected Patents Related to Thermal Spraying

Issued between 1 July 2002 and 30 September 2002

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US denotes U.S. patent, WO denotes World Organization patent, EP denotes European patents, and JP denotes Japanese patent. Due to differences in databases, not all data are available for each patent.

Applications

Aluminum Sliding Material

Aluminum Alloy Thermal Sprayed Layer Having Excellent Sliding Characteristic and Sliding Material. To solve the problem that, in a thermal sprayed layer of a silicon-added aluminum alloy, wear is made easy to occur because the matrix is hardened and is made brittle. The thermal sprayed layer contains an aluminum alloy containing 12 to 60 wt% Si, and in which silicon particles are dispersed. The average surface hardness of the aluminum alloy matrix is controlled to the range of $50 = H = (5/2)\mathrm{Si(wt\%)} + 75$ by heat treatment or the like.

JP2002206158A2. K. Hideaki and T. Yamada. Company: Taiho Kogyo Co Ltd. Issued/Filed: 26 July 2002/20 Jan 1999.

Antimicrobial Coating

Antimicrobial Powder Coating. Improved powder coatings exhibit enhanced resistance to bacterial and fungal attack, while possessing excellent toughness, appearance, corrosion resistance, durability, processibility, and ease of application. The coating comprises antimicrobial agents melt-processed into the matrices of coating powders or bonded to coating powders. An article may be coated with a thermoset or thermoplastic powder that may be applied by electrostatic spray or fluidized bed or by thermal or flame spray.

US6432416. F.L. Cummings, P. Gottschling, J.R. Hagerlin, O.H. Decker, and M.A. Sparks. Company: Dupont Powder Coatings USA, Inc., Houston, TX. Issued/Filed: 13 Aug 2002/16 Nov 2000.

Bearing Coatings

Electrolytic Corrosion Prevention Bearing and Method of Manufacturing Outer Ring of the Bearing. To provide an electrolytic corrosion prevention bearing free from the variation and nonuniformity of the film thickness of a ceramic thermally sprayed insulation layer and having an excellent dimensional accuracy, a rotating accuracy, and electric insulation performance and a method of manufacturing the outer ring thereof. In this electrolytic corrosion prevention bearing having a ceramic thermally sprayed insulation layer formed on the outer peripheral surface of an outer ring through the width surface thereof, a reference surface for grinding the outer peripheral surface and the width surface thereof is provided on the inner peripheral surface of the outer ring. The reference surface may be a raceway track surface formed of a tapered surface and may be a surface provided separately from the raceway track surface. Thus, when the width surface and outer peripheral surface of the outer ring are ground after the insulation layer is thermally sprayed, the outer ring can be supported on the reference surface provided on the inner peripheral surface thereof for grinding.

JP2002206542A2. A. Tomitani, K. Masuoka, and T. Murata. Company: NTN Corp. Issued/Filed: 26 July 2002/10 Jan 2001.

Brake Parts

Brake Part. To provide a brake part that is light weight and excellent in heat resistance and abrasion resistance properties. The brake part is made of the aluminum alloy where a thermal spraying layer made of metallic-ceramic composite material formed by thermal spraying an aluminum powder or mixed powder of an aluminum alloy and a ceramic powder is formed on a sliding face.

JP2002188663A2. H. Takahashi, S. Chonabayashi, and Y. Onimaru. Company: Taiheiyo Cement Corp. Issued/Filed: 5 July 2002/21 Dec 2000.

Catalysts

Use of a Catalyst and Process for Cleaning a Used Catalyst. Use in a combustion-plant waste gas laden with a heavy-metal component of a catalyzer with a catalytically active surface for pollution abatement that has been applied by thermal spraying.

EP0830888B1. E. Hums and R. Sigling. Company: Siemens Aktiengesellschaft. Issued/Filed: 31 July 2002/8 Sept 1997.

Capacitors Materials

Method for Preparation of a Thermal Spray Coated Substrate for Use in an Electrical Energy Storage Device. A pseudocapacitive material contacted to a substrate by a thermal spraying process is described. Suitable thermal spraying processes include chemical combustion spraying and electrical heating spraying, using both wire and powder processes. The thusly coated substrate is useful as an electrode in an electrical energy storage device such as a capacitor, an electrochemical cell, and the like.

US6455108. B.C. Muffoletto, A. Shah, and N.N. Nesselbeck. Company: Wilson Greatbatch Ltd., Clarence, NY. Issued/Filed: 24 Sept 2002/26 July 2000.

Cleaning

Combined Plasma/Liquid Cleaning of Substrates. Apparatus and method for cleaning substrates. A substrate is held and rotated by a chuck, and an atmospheric pressure plasma jet places a plasma onto predetermined areas of the substrate. Subsequently liquid rinse is sprayed onto the predetermined areas. In one embodiment, a nozzle sprays a gas onto the predetermined areas to assist in drying the predetermined areas when needed.

WO02072286A1. G. Selwyn and I. Henins. Company: The Regents of the University of California, Los Alamos National Laboratory, Los Alamos, NM. Issued/Filed: 19 Sept 2002/7 March 2002.

Coated Bores

Method and Device for the Production of Coated Bores. The invention relates to a method and device for the production of coated bores, whereby the bore wall is plasma sprayed with a coating material after formation of the bore. According to the invention, an adequate resistance of the coating of the bore wall to mechanical loads may be achieved, whereby the bore wall is subjected to a roller burnishing.

WO02072907A1. G. Dannemann, H. Schäfer, and W. Zwink. Company: DaimlerChrysler AG, Stuttgart, Germany. Issued/Filed: 19 Sept 2002/31 Jan 2002.

Composite Coating

Thermal Spray Forming of a Composite Material Having a Particle-Reinforced Matrix. To prepare a thermally sprayed composite material, a precomposited powder is first prepared and then thermally sprayed at an ambient pressure of no less than about 0.75 atm in an oxidation-preventing atmosphere. The precomposited powder has a plurality of powder particles, and each powder particle is formed of a matrix and reinforcing particles distributed within and encapsulated by the matrix. The matrix has a composition of a matrix metal such as molybdenum, hafnium, zirconium titanium, vanadium, niobium, tantalum, or tungsten, and a matrix nonmetal of silicon, boron, or carbon. The reinforcement particle is silicon carbide, boron carbide, silicon nitride, or boron nitride.

US6436480. K. Upadhya. Company: Plasma Technology, Inc., Torrance, CA. Issued/Filed: 20 Aug 2002/29 June 2000.

Compressor Shoe

Shoe for Swash-Plate Type Compressor. A method of manufacturing a shoe including cutting a columnar raw material to a given length to provide a disc-shaped raw material, forming on one end face of the disc-shaped raw material a spherical sliding surface that is to be disposed in sliding contact with a spherical surface on a piston, and forming a thermal sprayed layer on the other end face of the disc-shaped raw material. The thermal sprayed layer serves 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 can be manufactured inexpensively.

US6435047. Y. Kitagawa, S. Muramatsu, M. Akizuki, and H. Asano. Company: Taiho Kogyo Co., Ltd., Toyota, Japan. Issued/Filed: 20 Aug 2002/26 March 1999.

Cutting Knife

Cutting Knife for Severing Tough Elastic Materials and Production Method Therefore. A cutting knife and a method for production are provided, the knife being suitable for severing tough, elastic material, in particular cement beads of window panes cemented in motor vehicles. The knife comprises a securement portion having a securement receptacle for securing the cutting knife to an oscillatory drive of a cutting tool, and a cutting portion with at least one cutting edge. The cutting knife comprises a plurality of flat bonded layers, which are preferably bonded together by forging. Additionally or alternatively, an outer wear-resistant layer is applied, preferably by thermal spraying. The cutting knife has an improved elasticity and increased bending strength in combination with improved cutting properties.

US6422110. B.G. Wurst and S. Gahlert. Company: C & E. Fein GmbH & Co., Germany. Issued/Filed: 23 July 2002/25 July 2000.

Golf Clubs

Golf Club Having a Thermic Spray Coating. The invention relates to a golf club with a striking surface for striking golf balls. The golf club has a coating applied by a thermal spray method at least in the area of the striking surface. The club coatings are preferably applied by a high-speed flame spray method or by a cold gas spray method. For coating golf clubs by hot spraying, in particular metals, metal alloys, oxides, (especially Al_2O_3 and/or TiO_2), carbides, borides, plastics, or mixtures of the above substances can be used as the spray materials.

US6419593. P. Heinrich and H. Kreye. Company: Linde Technische Gase GmbH, Hoellriegelskreuth, Germany. Issued/Filed: 16 July 2002/22 Dec 1998.

Intermetallic Coating

Method for Coating and Protecting a Substrate. A method of coating a substrate is provided. A metallic layer comprising at least about 8% Ni is deposited by thermal spraying on a substrate. The metallic layer has an average density greater than about 80%. A slurry layer comprising from about 10% to about 90% Al or alloy thereof is deposited on the metallic layer. Heating to a temperature in excess of 500 °C (932 °F) results in the formation of an intermetallic layer of NiAl. The resulting coating is particularly suited for protecting the surfaces of incinerators or other combustion chambers.

US6428630. G.P. Mor and M.F. Mosser. Company: Sermatech International, Inc., Limerick, PA and Flame Spray S.P.A., Milan, Italy. Issued/Filed: 6 Aug 2002/18 May 2000.

Lubricating Coatings

Lubricating System for Thermal Medium Delivery Parts in a Gas Turbine. Cooling steam delivery tubes extend axially along the outer rim of a gas turbine rotor for supplying cooling steam to and returning spent cooling steam from the turbine buckets. Because of the high friction forces at the interface of the tubes and supporting elements due to rotor rotation, a low coefficient of friction coating is provided at the interface of the tubes and support elements. On each surface, a first coating of a cobalt-base alloy is sprayed onto the surface at high temperature. A portion of the first coating is machined off to provide a smooth, hard surface. A second ceramic-based solid-film lubricant is sprayed onto the first coating. By reducing the resistance to axial displacement of the tubes relative to the supporting elements due to thermal expansion, the service life of the tubes is substantially extended.

US6422818. T.C. Mashey. Company: General Electric Co., Schenectady, NY. Issued/Filed: 23 July 2002/26 Jan 2001.

Pressure Vessel

Pressure Vessel Assembly. A pressure vessel is provided for housing electronic components in an underwater environment and permitting connection of the components to signal transmission elements of a signal cable. The pressure vessel comprises a hollow steel shell defining an interior chamber adapted to house the electronic components. A layer of thermal sprayed aluminum covers the shell. The shell has an opening adapted to pass the signal transmission elements into the interior chamber. A seal adapted to surround the transmission elements is disposed in the opening in the shell so that an outer peripheral surface of the seal contacts an inner peripheral surface of the opening in the shell for preventing moisture penetration into the interior chamber. The seal may be formed of epoxy and the outer peripheral surface may have a plurality of compressible O-rings disposed in axially spaced circumferential grooves for contacting the inner peripheral surface of the opening in the shell.

US6434317. D.P. Dyer, K.L. Heybrock, A.D. Tysinger, and J. Reinhart. Company: General Dynamics Advanced Technology Systems, Inc., Greensboro, NC. Issued/Filed: 13 Aug 2002/13 Nov 2000.

Resistor

Nonlinear Resistor and Manufacturing Method of the Same. A nonlinear resistor comprising of a sintered body including

zinc oxide as the main component, said sintered body having an upper surface, a lower surface, and a side surface; an insulating layer formed on the side surface of the sintered body; and a pair of electrodes formed on the upper surface and the lower surface of the sintered body, respectively, by plasma spraying, characterized in that the electrodes have a porosity of equal to or less than 15%, the electrodes contain a metal oxide and a metal, and the weight percentage of the metal oxide contained in the electrodes is set to equal to or less than 25%, and the electrodes have an average surface roughness of equal to or less than 8 μm.

EP0924714B1. H. Andoh, Y. Itoh, H. Suzuki, and S. Nishiwaki. Company: Kabushiki Kaisha Toshiba. Issued/Filed: 28 Aug 2002/21 Dec 1998.

Roller

Conveying Roller for Photosensitive Material and Method of Producing the Same. Continuous photo film includes a support of resin film having a back surface. A photosensitive layer of photographic emulsion is disposed on a surface of the support opposite to the back surface. A conveying roller conveys the continuous photo film. The conveying roller includes a roller body of metal. A hardness reinforcer layer is formed on a surface of the roller body by thermal spraying of ceramic or cermet, so that the roller body surface is prevented from being scratched or ground by the back surface of the film.

US6447179. A. Sanda, T. Kubo, H. Matsuzawa, and M. Wada. Company: Fuji Photo Film Co., Ltd., Kanagawa, Japan. Issued/Filed: 10 Sept 2002/1 Sept 1998.

Surface Enhancement

Method for Enhancing the Surface of a Substrate and Catalyst Products Produced Thereby. A method of treating the surface of a substrate by thermally spraying large size particles, >10 μm, of a composition such as a metal hydroxide, carbonate, or nitrate directly onto the substrate whereby a small-size particle coating, <5 μm and more particularly <3, is formed on the substrate, enhancing the surface area and porosity properties of the substrate, and substrates with metal oxide surfaces produced thereby.

WO02063061A2. T. He. Company: Honda Giken Kogyo Kabushiki Kaisha, Minato-ku, Tokyo, Japan. Issued/Filed: 15 Aug 2002/17 Dec 2001.

Tooling

Thermal Sprayed Tooling. A metallic shell—used, for example, as a mold—is formed by spray deposition connected to a base by rods or other supports connected to mounting elements that are incorporated in the shell during the deposition process. The shell can incorporate different metals to provide different thermal conductivity in various regions.

US6447704. C.P. Povino. Company: GMIC, Corp., Linden, NJ. Issued/Filed: 10 Sept 2002/23 May 2000.

Waste Treatment

Method for Treatment of Hazardous Fluid Organic Waste Materials. Method for treatment of fluid hazardous, organic waste materials, where a plasma of 2000-5000 °C temperature is generated by means of an electric arc in a plasma generator, the plasma torch is directed into a reactor, the reactor consists of three zones, the plasma torch being introduced downward into the uppermost first zone, the fluid waste being sprayed into the plasma torch in the first zone, where it is heated to a temperature range of 1300-1600 °C, the mixture of the plasma and the waste is introduced into the second zone of the reactor, where an oxidizing material is added to the mixture, the combustion gas produced in the second zone is then led into the third zone of the reactor, where it is cooled rapidly by water spraying to a temperature range of 120-160 °C, the cooled combustion gas is removed from the third zone of the reactor is led into a cooler. The plasma torch is generated from the mixture of carbon dioxide and oxygen, the oxidizing material introduced into the second zone of the reactor is a mixture of carbon dioxide and oxygen. Subsequently the water content of the combustion gas is separated by condensing and is removed, and the residual combustion gas is removed.

WO02068114A1. T. Berecky, T. Gyõry, L. Herédy, A. Herpay, and F. Pócsy. Company: Hungaroplazma Környezetvédelmi Szolgáltató Kft., Budapest, Hungary. Issued/Filed: 6 Sept 2002/26 Feb 2001.

Wear-Resistant Part

Wear-Resistant Sliding Member. A wear-resistant sliding member that comprises a base metal and a sprayed coating film formed by thermally spraying a mixed powder comprising 30-70 mass% of a molybdenum powder, 10-40 mass% of a nickel-chromium alloy powder, 3-40 mass% of a ceramic powder, and 2-15 mass% of a solid lubricant onto a sliding surface of the base metal. The wear-resistant sliding member is excellent in wear resistance and the resistance to scuffing and thus can be used in a diesel engine for a large shipborne that is used under severe conditions.

WO02068706A1. H. Takamura. Company: Nippon Piston Ring Co., Ltd., Saitama-shi, Saitama, Japan, and Man B & W Diesel A/S, Copenhagen, Denmark. Issued/Filed: 6 Sept 2002/22 Feb 2002.

X-Ray Tubes

High-Emissive Coatings on X-Ray Tube Components. An x-ray tube having one or more components, such as the rotor, that include a coating of relatively high emissivity. The coating, a metal oxide composition, for example, is selectively applied to desired portions of the component by plasma spray or similar process. The relatively high emissivity of the coating enhances the ability of the coated surface to radiate heat and thereby aids in implementation of a cooling effect with respect to the x-ray tube.

US6456692. R.B. Smith. Company: Varian Medical Systems, Inc., Palo Alto, CA. Issued/Filed: 24 Sept 2002/28 Sept 2000.

Feedstock

Bond Coat Material

Oxidation-Resistant and Low Coefficient of Thermal Expansion NiAl-CoCrAlY Alloy. A bond coat composition for use in thermal barrier coatings comprises a NiAl-CoCrAlY matrix containing particles of AlN dispersed therein. The bond coat composition is prepared by cryomilling NiAl and CoCrAlY in liquid nitrogen.

US6454992. M.G. Hebsur. Company: Ohio Aerospace Institute, Cleveland, OH. Issued/Filed: 24 Sept 2002/29 Sept 2000.

Feedstock Materials

Ceramic Powder

Ceramic Materials in Powder Form and Method for Their Preparation. The invention relates to a ceramic material in powder form comprising particles having an average particle size of 0.1 to 30 μm and each formed of an agglomerate of grains with each grain comprising a nanocrystal of a ceramic material of formula (I): $Si_{3-x}Al_xO_yN_z$, wherein $0 = x = 3$, $0 = y = 6$ and $0 = z = 4$, with the proviso that when x is 0 or 3, y cannot be 0. The

ceramic material in powder form according to the invention is suitable for use in the production of ceramic bodies by powder metallurgy, as well as in the formation of heat-resistant coatings by thermal deposition. The ceramic bodies and coatings obtained have improved resistance to thermal shocks.

WO02057182A3. S. Boily, P. Tessier, and H. Alamdari. Company: Groupe Minutia Inc., Boucherville, Québec, Canada. Issued/Filed: 25 July 2002/18 Jan 2002.

Cored Wire

Multiplex Composite Powder Used in a Core for Thermal Spraying and Welding, Its Method of Manufacture and Use. A multiplex powder composite for use in a cored wire electrode to be deployed in a thermal spray or welding apparatus. 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.

US6428596. D.J. Urevich and J.P. Hughes. Company: Concept Alloys, L.L.C., Whitmore Lake, MI. Issued/Filed: 6 Aug 2002/13 Nov 2000.

Wire for Thermal Spraying System. A wire for use in thermal spraying, the wire having sheath material—e.g., zinc, zinc alloy, aluminum and/or aluminum alloy, and core material, e.g., copper and/or copper alloy. A method for thermal spraying, the method including spraying a coating onto an object (e.g., but not limited to a vessel's hull with a thermal spray system, the thermal spray system using such wire or powder to produce the coating, the wire or powder including first material acting as a cathode and second material acting as a biocide for marine growth.

US6428858. J.B. Bolton, Montgomery, TX, and B.M. Rogers, Houston, TX.

Refractory Materials

Refractory Hard Metals in Powder Form for Use in the Manufacture of Electrodes. The invention relates to a refractory hard metal in powder form comprising particles having an average particle size of 0.1 to 30 μm and each formed of an agglomerate of grains with each grain comprising a nanocrystal of a refractory hard metal of the formula (I): $A_xB_yX_z$ wherein A is a transition metal, B is a metal selected from the group consisting of zirconium, hafnium, vanadium, niobium, tantalum, chromium, molybdenum, manganese, tungsten and cobalt, X is boron or carbon, x ranges from 0.1-3, y ranges from 0-3, and z ranges from 1-6. The refractory hard metal in powder form according to the invention is suitable for use in the manufacture of electrodes by thermal deposition or powder metallurgy.

WO02053495A1. S. Boily and M. Blouin. Company: Groupe Minutia Inc., Boucherville, Québec, Canada. Issued/Filed: 11 July 2002/2 Jan 2002.

Spray Methods

Arc System

Thermal Spraying Method and Apparatus. A thermal spraying method involves the creation of a coating comprising titanium wire in the presence of nitrogen. The apparatus of the invention comprises a nozzle that has a cylindrical throat, with feedstock guides that guide the feedstock wires to a point of intersection in the throat. A current is passed through the wires to cause an arc in the throat, and a nitrogen-rich gas under pressure is forced through the throat, generating a spray of molten particles that is used to coat a substrate. In a variation of the method, one of the feedstock wires comprises a binder metal, which produces a coating having enhanced toughness.

US6431464. M.W. Seitz. Company: Metalspray U.S.A., Inc., Richmond, VA. Issued/Filed: 13 Aug 2002/9 July 2001.

Arc Deposited Oxide Coating

Protective Coating by High Rate Arc Plasma Deposition. A method for depositing adherent metal oxide-based protective coatings on glass, metal, and plastic substrates by arc plasma deposition.

US6432494. B.L.-M. Yang and S.M. Gasworth. Company: General Electric Co., Niskayuna, NY. Issued/Filed: 13 Aug 2002/28 April 2000.

Continuous Spraying

Method for Continuous Thermal Deposition of a Coating on a Substrate. Continuous bath or curtain processes for the thermal deposition of a coating from a coating solution onto a moving metal web are used to apply a coating onto the web. The compositions that result from the processes are substantially free of defects relative to batch processes. The continuous process is particularly applicable for priming zinc and zinc-alloy coated steel webs.

US6428851. F.J. Friedersdorf, R. Venkataraman, M.J. Danilich, K.-C. Chou, G.E. Donchez, J.D. Hoffman, and T.A. Suchy. Company: Bethlehem Steel Corp. Issued/Filed: 6 Aug 2002/1 March 2000.

Inverse Mold Manufacturing

Manufacturing Method for Mold. To provide a manufacturing method for a mold that enables manufacturing of the mold with ideal accuracy and high manufacturing efficiency. After forming a ceramic layer by thermally spraying ceramic to the surface of a base material consisting of aluminum, the base material is soaked into soluble solution to be dissolved and flowed out so that the ceramic layer is molded.

JP2002192300A2. N. Yunoki. Company: Ishikawajima Harima Heavy Ind Co Ltd. Issued/Filed: 10 July 2002/27 Dec 2000.

Spray Forming

Thermal Spraying Method to Three-Dimensional Article. To provide a thermal spraying method to three-dimensional articles, such as mufflers, which is capable of easily drawing characters or patterns by thermal spraying to the three-dimensional articles while maintaining decorativeness. This thermal spraying method to the three-dimensional articles has a prepolishing process step of subjecting the segments to be drawn as the character of a blank to buffing, a thermal spraying process step of subjecting the segments buffed in the prepolishing process step to surface preparation by a shot-blasting process step, then drawing the characters thereto by thermal spraying, a working process step of subjecting the blank thermally sprayed in the thermal spraying process step to rolling to a three-dimensional shape, and a postpolishing process step of buffing the surface exclusive of the segments polished in the prepolishing process step.

JP2002212701A2. N. Ishizawa. Company: Shinba Iron Works Inc. Issued/Filed: 31 July 2002/19 Jan 2001.

Spraying Rotors

Surface Treatment of Helically Profiled Rotors. A treatment jet or beam, e.g., from a high-velocity oxyfuel (HVOF) spray gun, has an axis intersecting the surface of a rotor at a given point. The rotor has a profile that progresses helically along it. The point is traversed along the rotor while keeping the point at the same position on the rotor profile. In particular the jet axis is moved parallel to the rotor

axis while the rotor is rotated in synchronism.

US6425745. P.A. Lavin. Company: Monitor Coatings and Engineers Limited, United Kingdom. Issued/Filed: 30 July 2002/3 May 2001.

Thick Coatings

Method for Applying Thick Thermal Spray Coating, Thick Thermal Sprayed Coating, and Fan or Blower with the Coating. To provide a method for obtaining a stable thick thermal spray coating having adequate adhesiveness even on a machine part that has been conventionally considered to be difficult, thick thermal sprayed coating, and fan or blower with the coating. The method for obtaining a thick thermal spray coating consisting of a cermet material by a high-speed flame spray coating, which has strength of sprayed coating of s_a [MPa] and residual stress in the coating of s_1 [MPa] comprises, adjusting the residual stress s_0 [MPa] of the surface to be sprayed, beforehand, so as to be $s_0 - s_1 = s_a$, and thermally spraying the cermet material.

JP2002194521A2. Y. Ishimori, Y. Azuma, S. Sato, and Y. Takazawa. Company: Nippon Steel Corp. Issued/Filed: 10 July 2002/26 Dec 2000.

Spray Systems

Arc Spray System

Method and Device for Arc Thermal Spraying. To provide an arc thermal spraying device capable of stably maintaining arc to realize stable operation and efficiently atomizing a wire for thermal spraying. The wires and for thermal spraying are fed toward a target point C while guided by two wire guide pipes, and tips of the wires are brought into contact with each other to generate arc. A merging point of the primary gas flow is set close to the target point, the beamlike primary gas flow flowing toward the merging point along the direction inclined to the axis of thermal spraying from an area outside an area in which two wire guide pipes are disposed is generated, and molten metal is atomized by blowing this primary gas flow to a molten portion of the tips of the wires.

JP2002206159A2. K. Arisaka, T. Nagashima, and H. Tsujii. Company: Daihen Corp. Issued/Filed: 26 July 2002/28 Dec 2000.

Plasma Spray System

Plasma Coating Apparatus, and Plasma Coating Method. To provide a plasma coating apparatus and a plasma coating method capable of preventing abnormal discharge. This plasma coating apparatus comprises a vacuum vessel, a magnetic field generator, a current control device for controlling magnetic flux density, and an RF application device. An aluminum pipe of the inside diameter of 10 mm is disposed in the vessel so as to cover the periphery of a copper target disposed on the axis of the vessel. The magnetic field by the magnetic field generator is applied in the vessel, and argon gas is introduced therein. The voltage is applied to the target by the RF application device (the pipe is grounded), and discharge is generated between the target and the pipe to deposit copper on an inner surface of the pipe. The copper deposition condition includes the distance between the pipe and the target being 1-10 (mm), the pressure in the vessel being 666e–5 to 266e–2 [Pa], supplied power per unit area of the target being 0.1-1.2 [W/cm^2], the frequency of the RF application device 4 being 1 [M] to 50 [MHz], and the magnetic flux density being 130-1500 [G].

JP2002206167A2. A. Ui. Company: Toshiba Corp. Issued/Filed: 26 July 2002/28 Dec 2000.

Thermal Spray Torch

Torch for Thermal Spraying. A torch for thermal spraying stored rotatably in the front portion of a nozzle and having a delivery mouth ring with a droplet passage at the center thereof, wherein a projection converting the discharge direction of droplets is formed at the tip part center of the delivery mouth ring, an air injecting space allowing rotating air to be blown therein is formed at the rear end of the delivery mouth ring projectedly from the delivery mouth ring by integrally forming with each other a plurality of arm parts disposed in an air blowing tube stored in an outer tube, and a rotating force is given to the delivery mouth ring by the air blown from an air blowing port disposed on the outside of the air blowing space so as to bring the rotation speed of the delivery mouth ring for radially discharging the droplets into the range of 800-6000 rpm, whereby thermal spraying can be performed on the internal surfaces of the pipes and cylinders, and the thickness of a thermal spraying film can be optimized.

WO02060593A1. T. Shimazu. Company: Shimazu Kogyo Yugengaisha, Gifu-shi, Gifu, Japan. Issued/Filed: 8 Aug 2002/29 Jan 2001.

Thermal Barrier Coatings

Thermal Barrier Coating Ceramic Structure. A multilayered ceramic topcoat of a thermal barrier coating system is useful for high-temperature corrosive applications such as hot section components in gas turbine engines. The ceramic topcoat includes at least two layers, each having generally columnar grain microstructures with different grain-orientation directions. A preferred method of producing the multilayered ceramic topcoat includes positioning a superalloy substrate at a first angled orientation relative to a ceramic vapor cloud in an electron beam physical vapor deposition apparatus for a time sufficient to grow a first ceramic layer. The substrate is then reoriented to a second, different angled orientation for a time sufficient to grow a second ceramic layer. The ceramic layers exhibit columnar microstructures having respective grain-orientation directions that are related to the first and second substrate orientations. For uniformly coating a complex contoured surface such as a turbine blade airfoil, the blade can be rotated during coating deposition at each angled orientation. Alternatively, the article may be continuously reoriented according to a predetermined speed cycle to produce generally arcuate, sinusoidal, helical, or other columnar grain microstructures.

US6455173. G.H. Marijnissen, A.H.F. Van Lieshout, G.J. Ticheler, H.J.M. Bons, and M.L. Ridder. Issued/Filed: 24 Sept 2002/16 Jan 2001.

Thermal Barrier Coating Applied with Cold Spray Technique. A process for applying a thermal barrier coating to a turbine component—including the step of depositing a bond coating layer—by directing solid particles using a cold spray process. The layer of bond coating material may have different depths in different areas of the component, and it may have different compositions across its depth. The precise control afforded by the cold spray material deposition step allows the surface of the bond coating material layer to be formed with a predetermined surface roughness or with a plurality of microridges in order to optimize its bond to the overlying ceramic insulating layer.

US6444259 and WO02061177A2. R. Subramanian, G.P. Wagner, and B.B. Seth. Company: Siemens Westinghouse Power Corp., Orlando, FL. Issued/Filed: 3 Sept 2002/30 Jan 2001.

Ceramic Thermal Barrier Layer for Gas Turbine Engine Component. An article

that is particularly well suited for use as a gas turbine engine component has a metallic substrate and a ceramic thermal barrier layer including a mixed-metal oxide system comprising a compound selected from the group consisting of (1) a lanthanum aluminate and (2) a calcium zirconate, the calcium in which is partially replaced by at least one calcium-substitute element, such as strontium (Sr) or barium (Ba). In addition, the lanthanum in the lanthanum aluminate can be partially replaced by a lanthanum-substitute element from the lanthanide group, particularly gadolinium (Gd). A process for producing such an article comprises providing a prereacted mixed-metal oxide system as described above and applying it to the substrate by plasma spraying or an evaporation coating process.

US6440575. B. Heimberg, W. Beele, K. Kempter, U. Bast, T. Haubold, M. Hoffmann, A. Endriss, P. Greil, C.-W. Hong, F. Aldinger, and H.J. Seifert. Company: Siemens Aktiengesellschaft, Munich, Germany and Rolls-Royce Deutschland GmbH, Oberursel, Germany. Issued/Filed: 27 Aug 2002/1 May 2000.

Method of Forming a Diffusion Aluminide Coating. A thermal barrier coating system and a method for forming the coating system on a component designed for use in a hostile thermal environment, such as superalloy turbine, combustor and augmentor components of a gas turbine engine. The coating system includes a diffusion aluminide bond coat whose oxide growth rate is significantly reduced to improve the spallation resistance of a thermal barrier layer by forming the bond coat to include a dispersion of aluminum, chromium, nickel, cobalt, and/or platinum group metal oxides. The oxides preferably constitute about 5 to about 20 vol% of the bond coat. A preferred method of forming the bond coat is to initiate a diffusion aluminizing process in the absence of oxygen to deposit a base layer of diffusion aluminide and then intermittently introduce an oxygen-containing gas into the diffusion aluminizing process to form within the bond coat the desired dispersion of oxides. Thereafter, a ceramic layer is deposited on the bond coat to form a thermal barrier coating.

US6440496. B.K. Gupta, T.E. Mantkowski, N.N. Das, and R.W. Heidorn. Company: General Electric Co., Schenectady, NY. Issued/Filed: 27 Aug 2002/19 Jan 2000.

Structure with Ceramic Foam Thermal Barrier Coating and Its Preparation. A protective structure includes a substrate made of a nickel-base superalloy component of a gas turbine engine, and a ceramic thermal barrier coating overlying and bonded to the substrate. The ceramic coating is an open-cell solid foam of aluminum oxide ceramic cell walls having a porous interconnected intracellular volume there between. The ceramic coating is prepared by depositing a precursor material onto the surface of the substrate. The precursor material includes a sacrificial ceramic, typically silicon dioxide, and a reactive metal, typically aluminum, that is reactive with the sacrificial ceramic to form an open-celled ceramic foam. The sacrificial ceramic and the reactive metal are reacted together to form ceramic cell walls of an oxidized ceramic of the reactive metal, preferably aluminum oxide, and an interconnected intracellular volume there between filled with an intracellular metal. The intracellular metal is thereafter removed to leave a porous intracellular volume.

US6428280. C.M. Austin and R.J. Grylls. Company: General Electric Co., Schenectady, NY. Issued/Filed: 6 Aug 2002/8 Nov 2000.

Protective Layer System for Gas Turbine Engine Component. An article that is particularly well suited for use as a gas turbine engine component has a ceramic thermal insulation layer overlaying a bonding layer. The bonding layer is an alloy comprising iron, cobalt, and/or nickel and either: the following group 1 elements (by weight percent): chromium: 3-50%, aluminum: 3-20%, yttrium and/or a rare-earth element: 0.01-0.5%, lanthanum: 0.1-10%, hafnium: 0-10%, magnesium: 0-10%, silicon: 0-2%; or the following group 2 elements (by weight percent): chromium: 3-50%, aluminum: 3-20%; yttrium and/or a rare-earth element: 0-0.5%, lanthanum: 0.1-10%, hafnium: 0.1-10%, magnesium: 0-10%, silicon: 0-2%.

US6416882. W. Beele and B. Heimberg. Company: Siemens Aktiengesellschaft, Munich, Germany. Issued/Filed: 9 July 2002/1 May 2000.

Bond Coats

Roughened Bond Coats for a Thermal Barrier Coating System and Method for Producing. A roughened bond coat comprises a screen that includes interwoven wires defining openings and a metallic material disposed on the screen. The screen and metallic material form a roughened bond coat possessing an uneven, undulated, and irregular surface. The metallic material may be one of a slurry and a powder, and applied by coating and spraying, respectively. A thermal barrier coating system, which is formed with and incorporates the roughened bond coat, exhibits greater adhesion of a thermal barrier coating and bond coat due to an increased interfacial surface area provided by the uneven, undulated, and irregular surface.

US6444331. A.M. Ritter, M.R. Jackson, and C.A. Johnson. Company: General Electric Co., Schenectady, NY. Issued/Filed: 3 Sept 2002/4 June 2001.

Nickel-Base Substrates

Preparation of a Nickel-Base Superalloy Article Containing a Reactive Element and Having a Decarburized Surface and Coating. A nickel-base superalloy article substrate has more nickel than any other element, a reactive element that is hafnium, zirconium, yttrium, lanthanum, or cerium, or combinations thereof, and a nominal bulk composition of carbon. A protective layer is deposited overlying the surface of the article substrate. The depositing of the protective layer includes steps of decarburizing locations where the carbon serves as a barrier to the diffusion of the reactive element from the substrate into the protective layer, and depositing an aluminum-containing protective layer overlying the substrate. The decreasing of the carbon concentration may be accomplished by decarburizing the substrate, depositing a platinum-containing layer and then decarburizing, depositing an aluminum-containing layer in a reducing atmosphere, or decarburizing the deposited protective layer. A ceramic thermal barrier coating may be deposited overlying the protective layer.

US6444053. I.T. Spitsberg, J.D. Rigney, and J.A. Pfaendtner. Company: General Electric Co., Schenectady, NY. Issued/Filed: 3 Sept 2002/28 Feb 2000.