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Selected Patents Related to Thermal Spraying

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Applications

Abradable Quasi-crystalline Coating. A thermally sprayed coating formed with a quasi-crystal-containing alloy, the alloy consisting essentially of, by wt.%: 10 to 45 Cu, about 7 to 22 Fe, 0 to 30 Cr, 0 to 30 Co, 0 to 20 Ni, 0 to 10 Mo, 0 to 7.5 W, and balance aluminum with incidental impurities. The alloy contains less than 30 wt.% psi phase and at least 65 wt.% delta phase. The coating has a macrohardness of less than HR15Y 90.

EP 1036855. F.J.M.A.E. Hermanek. Company: Praxair S.T. Technology, Inc. Issued/Filed: Oct 13, 2004/March 14, 2000.

Aluminum Oxide Based Thick Layers Produced by Plasma Jet Spraying. Al_2O_3-based layers having a total thickness of more than 0.3 mm are produced on a substrate by plasma jet spraying, said Al_2O_3-based layers having a laminar sandwiched structure wherein at least one Al_2O_3 layer is interpolated between two intermediate layers that are produced by plasma jet spraying as well, said intermediate layers consisting of a ceramic laminated material that is different from Al_2O_3 and that on cooling increases in volume by phase transition. Preferred materials for said intermediate layers are Al_2O_3/ZrO_2, Al_2O_3/TiO_2, ZrO_2/Y_2O_3, Y_2O_3/ZrO_2, ZrO_2/MgO, ZrO_2/CeO_2, and ZrO_2/CaO alloy systems.

CA 2314528. S. Zimmermann and G. Barbezat. Company: Sulzer Metco AG. Issued/Filed: Nov 2, 2004/July 25, 2000.

Bent Pipe and a Method for Preparing Thereof. There is an object to provide a technique of forming a proper abrasion resistance layer by a thermal spraying and fusing of a self fluxing alloy. The object may be solved by cutting the pipe body along a curved face that is perpendicular to a plane including a central axis of the pipe body and that extends not to cross the inlet hole and the outlet hole, but to include a part of the central axis. Thus the pipe body is divided into a first partitioned part having at least one of the inlet hole and the outlet hole, and a second partitioned part. An abrasion-resistant layer is then formed on the inner surface of at least the outer bent portion of the pipe body by a thermal spraying and fusing of a self-fluxing alloy. Thereafter, the first partitioned part is fitted into the second partitioned part for welding to obtain a bent pipe according to the present invention.

US 6799608. H. Koshika and S. Nishimura. Company: Fukuda Metal Foil & Powder Co., Ltd. Japan Overlay Industries Co., Ltd. Issued/Filed: Oct 5, 2004/June 19, 2000.

Glass Lining Application Method. A new glass lining application method enables stable, uniform glass lining layers to be applied to large glass-lined instruments composed of a stainless base material. The method includes forming a thermal spray treatment layer by applying a thermal spray treatment to a surface of a stainless base material using a thermal spray material selected from a group composed of a stainless material identical to the base material, nickel metal, chromium metal, iron metal, cobalt metal, nickel-chromium alloys, and iron-chromium alloys, then forming a glass lining layer on the thermal spray treatment layer by means of a glass lining heat treatment using a ground coat and a cover coat, a surface roughness (R_z) of the thermal spray treatment layer being within a range from 5 to 100 μm, and an open pore diameter being within a range from 3 to 60 μm.

US 6815013. Y. Iizawa, M. Shirasaki, and J. Ono. Company: Ikebukuro Horo Kogyo Co., Ltd. Issued/Filed: Nov 9, 2004/March 13, 2002.

Hot Runner Component Heater Having Thermal Sprayed Resistive Element. A hot runner component for heating and directing fluid material of a melt stream to a mold cavity is provided. The hot runner component includes a body having a fluid passageway therein for conveying the melt stream and a heater for heating the melt stream as the melt stream passes through the fluid passageway of the body. The heater includes a core arranged in surrounding relation to the fluid passageway of the body, a thermally sprayed dielectric substrate layer on the core, and a thermally sprayed electrical resistance element layer overlying the dielectric substrate layer. The resistance element layer forms a discrete pattern. The heater further includes a thermally sprayed dielectric overlay layer that overlies a substantial portion of the resistance element layer.

WO 4113044. I. Pisman and D.E. Crawmer. Company: Fast Heat, Inc. Issued/Filed: Dec 29, 2004/June 18, 2004.

Kinetically Sprayed Aluminum Metal-Matrix Composites for Thermal Management. Disclosed is a method for forming a heat sink laminate and a heat sink laminate formed by the method. In the method, a particle mixture is formed from a metal, an alloy, or mixtures thereof with a ceramic or mixture of ceramics. The mixture is kinetically sprayed onto a first side of a dielectric material to form a metal-matrix composite layer. The second side of the dielectric material is thermally coupled to a heat sink baseplate, thereby forming the heat sink laminate.

US 6808817. D.T. Morelli, A.A. Elmoursi, T.H. Van Steenkiste, B.K. Fuller, B.A. Gillispie, and D.W. Gorkiewicz. Company: Delphi Technologies, Inc. Issued/Filed: Oct 26, 2004/March 15, 2002.

Method for Producing a High-Quality Insulation for Electric Conductors or Conductor Bundles of Rotating Electrical 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.

US 6815012. T. Baumann and R. Fried. Company: Alstom Technology Ltd. Issued/Filed: Nov 9, 2004/Oct 17, 2002.

Method to Provide Wear-Resistant Coating and Related Coated Articles. This invention is directed to a coated article having an increased useful lifespan, having a wear-resistant coating comprising a vitreous matrix material and metal coated superabrasive particles distributed therein. The superabrasive particles are coated with a protective metal coating selected from zinc, aluminum, aluminum-silicon alloy, titanium, chromium, nickel, silicon, tin, antimony, copper, iron, stainless steel, silver, alloys thereof, and mixtures thereof. The wear-resistant coating comprising coated superabrasive particles may be applied to the surface of an article by at least one process selected from electroless or electrolytic electroplating process, thermal spraying, and brazing.

WO 4094685. T.F. Dumm and S.W. Webb. Company: Diamond Innovations, Inc. Issued/Filed: Nov 4, 2004/April 22, 2004.

Nanostructured Titania Coated Titanium. A ball valve for use in the pressure acid leaching of nickel ores is disclosed. The valve has a valve body and a ball centrally positioned in the valve body, which has a central passage rotatable in the valve body between open and closed positions. At least one seat is disposed between the ball and the valve body. The ball and seat each comprise a titanium substrate and an ultrafine or nanostructured titania coating. The titania can include from 5 to 45 vol.% of a second-phase material that is immiscible with the titania and exhibits corrosion resistance.

US 6835449. G.E. Kim, J. Walker, Jr., and J.B. Williams, Jr.. Company: Mogas Industries, Inc. Issued/Filed: Dec 28, 2004/Aug 5, 2002.

Shoe and Method for Manufacturing the Same. 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 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, which is formed with a sintered layer, and can be manufactured inexpensively.

EP 939224. Y. Kitagawa, S. Muramatsu, M. Akizuki, and H. Asano. Company: Taiho Kogyo Co., Ltd. Issued/Filed: Nov 17, 2004/Aug 4, 1998.

Surface Layer Forming a Cylinder Barrel Surface, a Spraying Powder Suitable Therefor and a Method of Creating Such a Surface Layer. A surface layer for forming a cylinder barrel wall of a combustion engine block is proposed. The surface layer has separate phases of components that are separated from the phase of the remaining materials. The surface layer is produced by plasma spraying an iron-containing spraying powder, incorporating all components of the layer to be produced. Such a surface layer may be applied easily and shows a significantly improved behavior regarding the machining thereof, without negatively influencing other important characteristics of the layer material, such as wear resistance and coefficient of friction vis-à-vis the material of the piston rings. Preferred components of the spraying powder are, besides iron, chromium, manganese, sulfur, and carbon. Moreover, the spraying powder can contain arsenic, tellurium, selenium, antimony, and/or bismuth.

CA 2347980. G. Barbezat. Company: Sulzer Metco AG. Issued/Filed: Dec 7, 2004/May 17, 2001.

Thermally Sprayed 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. 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. In another aspect, the coated article is one or more piston rings.

US 6833165. T.J. Smith, T. Stong, and P. Einberger. Company: Dana Corporation. Issued/Filed: Dec 21, 2004/Sept 26, 2002.

Use of Thermal Spraying with Niobium Oxides and Niobium Alloys During the Production Process of Rolled Steel Plates. This innovation describes the utilization of thermal spraying with niobium oxides and alloys in the manufacturing of rolled steel plates, to be applied in the production of thermal exchange equipment, or those that are exposed to atmospheres with corrosive gases in high temperature, as for example, H_2S and CO_2, as well as fumes from solvents and acids.

WO 4097061. L.R.M. Miranda, L.J. Carvalho, and A.C.G. Pereira. Company: COPPE/UFRG. Issued/Filed: Nov 11, 2004/Aug 18, 2003.

Wear-Resistant Coating for Brush Seal Applications. A metallic coating containing hard carbide particles is described. The coating is applied by an HVOF process using powder particles whose size ranges from about 15 to about 44 μm. The carbide particles are held in a 80%Ni-20%Cr matrix. The coating has a reduced tensile compressive stress relative to similar plasma sprayed coatings and exhibits a high strain to cracking value.

US 6815099. P.H. Zajchowski, M. Freling, S.M. Meier, R.R. Donovan, and G. Donovan. Company: United Technologies Corp. Issued/Filed: Nov 9, 2004/March 1, 2000.

Feedstock

Composite Wires for Coating Substrates and Methods of Use. A composite wire for producing a wear-resistant and corrosion-resistant coating on a substrate by thermal spraying, spray and fuse, or welding techniques are disclosed. The physical properties of the coating are particularly suited for high-temperature erosion-corrosion environments. The resultant coating exhibits good hardness, toughness, and bonding characteristics. The composite wire comprises a metallic outer sheath and an inner core containing boron carbide and chrome carbide.

WO 4111290. M.W. Seitz. Issued/Filed: Dec 23, 2004/May 27, 2004.

Thermal Spray Composition and Method of Deposition for Abradable Seals. A thermal spray composition and method of deposition for abradable seals for use in gas turbine engines, turbochargers, and steam turbines. The thermal spray composition comprises a mixture of metal-clad solid lubricant particles and

unclad solid lubricants particles for producing an abradable seal used in the compressor section of gas engines, aircraft engines, radial compressors, and the like. The metal is selected from alloys of nickel, cobalt, copper, iron, and aluminum, preferably nickel alloys, and the solid lubricant is at least one of hexagonal boron nitride, graphite, calcium fluoride, lithium fluoride, and molybdenum disulfide, preferably hexagonal boron nitride or hexagonal boron nitride and graphite.

US 6808756. K. Hajmrle and P. Fiala. Company: Sulzer Metco (Canada) Inc. Issued/Filed: Oct 26, 2004/Jan 17, 2003.

Pre- and Posttreatment

Method and Arrangement for Heat Treatment before the Execution of Spray Form Techniques. A method for implementing preheat treatment before spray forming begins to achieve stress control in the manufacture of a spray formed metallic article involves preheating either or both of a spray forming cell environment and a mold substrate, initiating application of the metallic spray forming material onto the mold substrate, and causing substantially homogenous initial metallic phase transformations from the austenite phase via a predetermined relationship between the initial application temperature of the spray forming material and the initial temperature of either or both of the preheated cell environment and the preheated mold substrate.

US 6805188. A.D. Roche, J.A. Szuba, S. Samir, and C. Mgbokwere. Company: Ford Global Technologies, LLC. Issued/Filed: Oct 19, 2004/Nov 27, 2001.

Procedure for the Preparation of a Surface. Preparing a surface to be coated with a thermally sprayed layer comprises removing material from the surface by machining and providing the surface with a rough structure. Furrows with crossing-linelike recesses are inserted into the surface.

DE 10314249. R. Biedermann, W. Boll, A.D.I. Heuberger, P.I. Izquierdo, Jr., D.I. Schmid, and H. Schwarz. Company: DaimlerChrysler AG. Issued/Filed: Oct 21, 2004/March 29, 2003.

Spraying Systems and Methods

Apparatus for Thermal Spray Processes. An improved design for a thermal spray gun includes an atomizer, a combustion chamber, an interconnector, and a barrel. Also included are methods for thermally spraying a substrate. One method for thermally spraying a substrate includes directing at least one fuel stream and at least one oxidant stream to a thermal spray gun with the improved design to form a thermal spray and directing the thermal spray against the surface to apply the coating.

WO 4098790. V. Sedov and R. Thorpe. Company: Praxair S.T. Technology, Inc. Issued/Filed: Nov 18, 2004/April 26, 2004.

Gaseous Thermal Spraying Method. The method involves spraying metal or nonmetal material onto threaded surface of part, producing coating on one side of each thread tooth inclined toward load causing wearing of surface, directing flow of particles at an angle of 75 to 90° to tooth surface to be sprayed in plane perpendicular to said surface, and feeding gas jet into flow of particles in direction perpendicular to flow of particles. Effect: reduced probability of cracking of coating and increased service life of friction pair.

RU 2238346. V.S. Goncharov, M.V. Goncharov, V.A. Lednev, and I.V. Demidov. Issued/Filed: Oct 20, 2004/Jan 20, 2003.

HVOF Wire Spray System. In a thermal spray process, a wire is fed into a flame jet to heat said wire to the melting point, atomize, and project at high-velocity the droplets so formed against a surface to build up a coating of material on the surface. The wire is fed into the flame by aligning the cast plane of the wire with the flame jet by using a tubular member formed into a circular shape to provide sufficient length for the guide wire and to provide the necessary twist amount to the wire to align the cast plane with the axis of the flame jet.

WO 4101173. J.A. Browning. Issued/Filed: Nov 25, 2004/March 11, 2004.

Low-Pressure Powder Injection Method and System for a Kinetic Spray Process. Disclosed is a method and a nozzle for a kinetic spray system that uses much lower powder pressures than previously used in kinetic spray systems. The method permits one to significantly decrease the cost of the powder delivery portion of the system, to run the system at higher temperatures for increased deposition efficiency, and to eliminate clogging of the nozzle. The nozzle is a supersonic nozzle having a throat located between a converging region and a diverging region, with the diverging region defined between the throat and an exit end. At least one injector is positioned between the throat and the exit end with the injector in direct communication with the diverging region. The powder particles to be sprayed are injected through at least one injector and entrained in a gas flowing through the nozzle. The entrained particles are accelerated to a velocity sufficient to cause them to adhere to a substrate positioned opposite the nozzle.

US 6811812. T.H. Van Steenkiste. Company: Delphi Technologies, Inc. Issued/Filed: Nov 2, 2004/April 5, 2002.

Method and Apparatus for High-Speed Flame Spraying. Flame spraying assembly is a Laval jet, with the tube for the spray particles axial and centrally within the outer jet body, outside the hot combustion chamber.

EP 1369498. P. Heinrich, H. Kreye, and T. Stoltenhoff. Company: Linde AG. Issued/Filed: Dec 22, 2004/May 16, 2003.

Method and Device for Plasma Coating Surfaces. A method for coating surfaces, for which a precursor material is caused to react with the help of plasma and the reaction product is deposited on a surface, the reaction as well as the deposition taking place at atmospheric pressure, such that a plasma jet is generated by passing a working gas through an excitation zone and the precursor material is supplied with a lance separately from the working gas to the plasma jet.

US 6800336. P. Fornsel, C. Buske, U. Hartmann, A. Baalmann, G. Ellinghorst, and K.D. Vissing. Issued/Filed: Oct 5, 2004/April 29, 2002.

Thermal Spraying Method and Apparatus for Improved Adhesion Strength. A thermal spraying method includes the steps of: (1) preparing a speed-increasing means for adding energy to the heated material or the heating material to increase a flying speed of the material and (2) adding energy to the heated material or the heating material by the speed-increasing means in such a manner that a flying speed of the heated material or the heating material increases until the material reaches a surface of an object.

US 6808755. N. Miyamoto, K. Kodama, and I. Marumoto. Company: Toyota Jidosha Kabushiki Kaisha. Issued/Filed: Oct 26, 2004/April 2, 2003.

Thermal Barrier Coatings and Bondcoats

Thermal Barrier Coating Having Low Thermal Conductivity. This invention provides a thermal barrier ceramic coating for application to a metallic article, with the ceramic coating having a formula of $Re_xZr_{1-x}O_y$ wherein Re is a rare earth element selected from the group consisting of Ce, Pr, Nd, Pm, Sm, Eu, Tb, Dy, Ho, Er, Tm, Yb, and Lu where $0 < x < 0.5$ and $1.75 < y < 2$. A preferred embodiment is wherein Re is Nd.

US 6803135. Y. Liu and P. Lawton. Company: Chromalloy Gas Turbine Corporation. Issued/Filed: Oct 12, 2004/Feb 24, 2003.

Thermal Barrier Coating Utilizing a Dispersion-Strengthened Metallic Bond Coat. The present invention relates to an overlay coating that has improved strength properties. The overlay coating comprises a deposited layer of MCrAlY material containing discrete nitride particles therein. The nitride particles are present in a volume fraction in the range of 0.1 to 15.0% and have a particle size in the range of from 0.1 to 10.0 μm. The coating may also have oxide particles dispersed therein.

US 6833203. S. Bose, D.A. Bales, M.T. Ucasz, M.W. Wight, S.M. Burns, and T.E. Royal. Company: United Technologies Corp. Issued/Filed: Dec 21, 2004/ Aug 5, 2002.

Thermal Barrier Layer and Process for Producing the Same. A device operable in a temperature environment in excess of about 1000 °C is provided. The device comprises a substrate and a ceramic thermal barrier layer deposited on at least a portion of the substrate. The layer is formed with a ternary or pseudo-ternary oxide having a pyrochlore or perovskite structure and a fugitive material and having pores or other voluminous defects. The thermal barrier layer advantageously is abradable.

US 6835465. D.B. Allen, R. Subramanian, and W. Beele. Company: Siemens Westinghouse Power Corp. Issued/Filed: Dec 28, 2004/May 13, 2002.