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Selected Patents Related to Thermal Spraying

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CA = Canadian patent, RU = Russian patent, SG = Singaporean patent, US = United States patent, WO = World Intellectual Property Organization application. The information has the following format: Title, Abstract, Patent number, Inventors, Company, Issued/Filed dates.

Applications

Corrosion-Resistant ABS Tone Ring. A tone ring of a vehicle antilock braking system of the type that is integrated into a disc brake rotor. The tone ring has a protective layer that enables it to withstand the combination of extreme heat and harsh environmental conditions to which it is exposed during operation of the vehicle. The protective layer is applied by thermally spraying the selected one of a plurality of materials, such as a nickel-based alloy, a high-chrome stainless steel, or nonferrous materials such as an aluminum, copper-based alloys, or a ceramic, on teeth of the tone ring, and without causing the protective layer to be deposited on the rotor braking surfaces. The protective layer generally prevents the formation of oxidation and corrosion by-product layers on the teeth, to thereby maintain sensitivity for detection of teeth movement by the antilock braking system sensor during operation of the system.

US 7306293: Chris A. Redgrave. Company: Hendrickson USA, L. L. C. Issued/Filed: December 11, 2007/December 10, 2004.

Delivery Roll and Hearth Roll for Continuous Annealing Furnace. A steel-sheet-manufacture delivery roll and hearth roll for continuous annealing furnace, provided on the surface thereof with a thermal-spray coating, wherein the thermal-spray coating consists of a cermet, or heat-resistant alloy, of 80 vol.% or less ceramic component content, and wherein on the thermal-spray coating, a layer of oxide is provided of at least one member selected from among sprayed metals, Cr, Si, Zr, and Al, and wherein the ratio of R/R' in which R is the roughness parameter obtained by measuring the surface of the oxide layer with its cutoff value set at an initial value in accordance with JIS B0633 while R' is the roughness parameter obtained by measuring with the cutoff value set at 1/10 of the initial value is 4 or higher.

WO 27148414: Yasushi Kurisu. Company: Nippon Steel Corp. Issued/Filed: December 27, 2007/July 12, 2006.

Forming a Molded Article Using Improved Thermal-Sprayed Tooling. A metallic shell used, for example, as a mold is formed by spray deposition connected to the 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 conductivities in various regions.

US 7311870: Charles P. Covino. Company: GMIC, Corp. Issued/Filed: December 25, 2007/February 2, 2005.

Mechanical Seals and Method of Manufacture. A mechanical seal structure and a method for manufacture that employs at least one ceramic seal face prepared by a thermal-spray process.

WO 27139618: Omar Sabouni, Jacobus Doesburg, Richard K. Schmid, Thomas H. Piquette, and David Gollob. Company: Sulzer Metco Venture LLC. Issued/Filed: December 6, 2007/April 3, 2007.

Metal Implants. An implant with a metal structure for use in a surgical procedure, in which the metal structure is provided with a roughened surface at the region of the implant to be in contact with bone. The roughened region is then provided with a ceramic coating comprising hydroxyapatite by a thermal-spray process. Biocidal ions of silver are absorbed into the ceramic coating and gradually leach out into body fluids after implantation. Hydroxyapatite enhances bone regrowth into the implant, while the silver ions suppress infection.

WO 27144667: Thomas C. Prentice, Martin E. L. Pickford, David R. Lewis, and Andrew D. Turner. Company: Accentus PLC. Issued/Filed: December 21, 2007/June 11, 2007.

Method for Manufacturing a Circuit Carrier. Method for manufacturing a circuit carrier in which a layer made of a dielectric material is thermally sprayed onto a metal support material, particularly made of aluminum or copper. The sprayed layer is made of a dielectric material having a multiplicity of pores, where a sealing material is sprayed onto the metal support material together with the dielectric material, so that the pores in the layer of dielectric material are sealed by the sealing material.

WO 27140495: Bernd Haegele. Company: AB Mikroelektronik GmBH. Issued/Filed: December 13, 2007/May 25, 2007.

Methods for Coating Conduit Interior Surfaces Utilizing a Thermal-Spray Gun With Extension Arm. Systems and methods for applying a coating to an interior surface of a conduit. In one form, a spray gun configured to apply a coating is attached to an extension arm that may be inserted into the bore of a pipe. The spray gun may be a thermal-spray gun adapted to apply a powder coating. An evacuation system may be used to provide a volume area of reduced air pressure for drawing overspray out of the pipe interior during coating. The extension arm as well as the spray gun may be cooled to maintain a consistent temperature in the system, allowing for more consistent coating.

US 7276264: Karen A. Moore and Raymond A. Zatorski. Company: Battelle Energy Alliance, LLC. Issued/Filed: October 2, 2007/May 3, 2005.

Piston Ring and Thermal-Spray Coating Used Therein, and the Method for Manufacturing Thereof. The piston ring of the present invention comprises a thermal-spray coating of chromium carbide particles having an average particle size of 5 μm or less, and a matrix metal composed of a Ni-Cr alloy or a Ni-Cr alloy and Ni at least on an outer peripheral surface. The thermal-spray coating has an average pore diameter of 10 μm or less and a porosity of 8% or less by volume. A piston ring having excellent wear resistance, scuffing resistance, and peeling resistance with little attackability on a mating member is obtained by forming a homogeneous thermal-spray coating having a fine microstructure.

US 7291384: Ryou Obara, Katsumi Takiguchi, and Yukio Hosotsubo. Company: Kabushiki Kaisha Riken. Issued/Filed: November 6, 2007/October 15, 2003.

Process for Making Corrosion-Resistant Amorphous-Metal Coatings From Gas-Atomized Amorphous-Metal Powders Having Relatively High Critical Cooling Rates Through Particle-Size Optimization (PSO) and Variations Thereof. A system for the deposition of full-density, pore-free, corrosion- resistant, thermal-spray, amorphous-metal coatings for the protection of a less corrosion-resistant substrate. The system uses particle-size optimization (PSO) to ensure that the amorphous metal particles are small enough for the critical cooling rate to be achieved in all the amorphous metal particles.

WO 27120207: Joseph C. Farmer, Jeffery J. Haslam, Nancy Yang, Enrique J. Lavernia, Julie Schoenung, Leo Ajdelsztajn, Larry Kaufman, Craig A. Blue, and John H. Perepezko. Company: The Regents of the University of California. Issued/Filed: October 25, 2007/November 13, 2006.

Sputter Target With Sputter Material Based on TiO_2, and a Production Method. The invention relates to a sputter target, with the sputter material based on TiO_2 that has 15-60 mol% of Nb_2O_5. It further relates to a method for the production of a sputter target consisting of the following steps: mixture of TiO_2 and Nb_2O_5 powder in liquid slurry—spraying of this slurry to cause granulation of the TiO_2-Nb_2O_5 mixed oxide mixture—plasma spraying of this granulated mixture onto the base body of a sputter target.

WO 27141003: Martin Weigert, Christoph Simons, and Eckehard Mannle. Company: W.C. Heraeus GmBH. Issued/Filed: December 13, 2007/June 6, 2007.

Thermal Oxidation Protective Surface for Steel Pistons. A piston and a method for making a piston for a fuel-injected diesel engine adapted to withstand the damaging effects of fuel injection plume-induced oxidation in the regions of the piston bowl and rim. The surfaces of the piston crown targeted by the fuel injection plume are first coated with a corrosion-resistant and oxidation-resistant composition applied as a slurry or by a thermal-spray technique, such as HVOF, or a plasma spray technique. Thereafter, a high-energy industrial laser beam irradiates the as-sprayed coating to increase its density, while simultaneously re-forming its microstructure so as to fuse, alloy, and materially bond the coating material with the underlying steel substrate, thereby resulting in a durable protective surface for the steel piston crown.

WO 27134148: Warran Lineton and Miguel Azevedo. Company: Federal-Mogul Corp. Issued/Filed December 11, 2007/May 10, 2007.

Thermal-Spray Coating of Porous Nanostructured Ceramic Feedstock. By engineering thermal-spray parameters, such as temperature and velocity, and feedstock powder size and morphology, ceramic coatings may be produced having the desired mechanical and thermal properties. The ceramic thermal-spray coating has a microstructure about 10-80% by cross-sectional area of a particulate phase based on surface area of the coating, and the particulate phase is uniformly distributed throughout the coating. The particulate phase is an unmelted portion of the thermal-spray feedstock, which is highly porous and may be produced by agglomerating nanoparticles of the ceramic. Such coatings can be applied as TBCs or as abradable coatings.

WO 27121556: Rogerio S. Lima, Basil R. Marple, and Christian Moreau. Company: National Research Council of Canada. Issued/Filed: November 1, 2007/April 18, 2007.

Thermal-Spray-Coated Work Rolls. This invention relates to thermally spray-coated work rolls for use in metal or metal alloy, e.g., aluminum alloy, sheet manufacture comprising a cylindrical structure having an outer peripheral surface and a thermally sprayed coating on the outer peripheral surface of the cylindrical structure. The thermally sprayed coating comprises about 65 to ~95 wt.% of one or more Group Vl metal carbides, and about 5 to about 35 wt.% of one or more transition metals selected from chromium, manganese, iron, cobalt, and nickel. This invention also relates to the process for preparing the work rolls for use in metal or metal alloy, e.g., aluminum alloy, sheet manufacture, a method for manufacturing metal or metal alloy, e.g., aluminum alloy, sheet using the thermally spray-coated work rolls, and a thermal-spray powder for coating the outer peripheral surface of the work rolls for use in metal or metal alloy, e.g., aluminum alloy, sheet manufacture.

WO 27133536: William Jarosinski. Company: Praxair S. T. Technology, Inc. Issued/Filed: November 22, 2007/May 8, 2007.

Diagnostics and Characterization

Method for Coating a Workpiece. The invention relates to a method for coating a workpiece, in which the material is applied to the workpiece by a thermal-spray process that is monitored and evaluated so as to establish online process control. According to this method, infrared emissions of the spray jet are detected with the aid of at least one infrared camera, and properties of the spray jet are determined by analyzing the infrared emissions of the spray jet, that are detected by each infrared camera.

WO 27147388: Andreas Kahny, Manuel Hertter, and Jurgen Steinwandel. Company: MTU Aero Engines GmBH. Issued/Filed: December 27, 2007/June 14, 2007.

Feedstock

Compositions of Corrosion-Resistant Fe-Based Amorphous Metals Suitable for Producing Thermal-Spray Coatings. A method of coating a surface comprised providing a source of amorphous metal that contains manganese (1 to 3 at.%), yttrium (0.1 to 10 at.%), and silicon (0.3 to 3.1 at.%) in the range of compositions given in parentheses. This contains the following elements in the specified range of compositions given in parentheses: chromium (15 to 20 at.%), molybdenum (2 to 15 at.%), tungsten (1 to 3 at.%), boron (5 to 16 at.%), carbon (3 to 16 at.%), and the balance iron. The amorphous metal is applied to the surface by spray.

WO 27120205: Joseph C. Farmer, Frank G. Wong, Jeffery J. Haslam, Xiaoyan Ji, Sumner D. Day, Craig A. Blue, John D. k. Rivard, Louis F. Aprigliano, Leslie K. Kohler, Robert Bayles, Edward J. Lemieux, Nancy Yang, John H. Perepezko, Larry Kaufman, Arthur Heuer, and Enrique Lavernia. Company: The Regents of the University of California. Issued/Filed: October 25, 2007/November 13, 2006.

Method and Apparatus for Nanopowder and Micropowder Production Using Axial Injection Plasma Spray. A method and a system for production of powders, such as micropowders and nanopowders, utilizing an axial injection plasma torch. The liquid precursor is atomized and injected into the convergence area of the plasma torch. The hot stream of particles is subsequently quenched and the resultant powders collected.

WO 27109906: Allan W. Burgess and Nikica Bogdanovic. Company: Northwest Mettech Corp. Issued/Filed: October 4, 2007/March 29, 2007.

Sprayable Coating Composition. A sprayable granite-like coating composition useful for forming simulated stone surfaces, such as polished granite, that have high-impact strength, superior hardness, and an esthetically pleasing look. The coating composition comprises gel resin matrix based on unsaturated crosslinkable polyester or acrylic resins, a curing accelerator composition, and granules comprising thermoset resins or mixtures of thermoplastic and thermoset resins. The gel coat resins and the granules are visually differentiable, substantially immiscible, and substantially equal in density. The composition is characterized by forming coatings of uniform thickness and quick curing that even at low thickness provides a uniform granite appearance.

WO 6130193: Akbar Ghahary and Yifang Zhao. Company: Safas Corp. Issued/Filed: October 25, 2007/February 23, 2006.

Thermal-Spray Powder. A thermal-spray powder includes cermet particles. Each cermet particle includes tungsten carbide particles having a mean primary particle size of 3 to 9 μm and metal particles or ceramic particles containing chrome. The mean particle size of the cermet particles is preferably from 2 to 50 μm, and the compression strength of each cermet particle is preferably from 400 to 900 MPa. Such a thermal-spray powder enables the formation of a thermal-sprayed coating that has both excellent cavitation erosion resistance and slurry erosion resistance.

US 7282079: Hiroaki Mizuno and Tsuyoshi Itsukaichi. Company: Fujimi Inc. Issued/Filed: October 16, 2007/December 22, 2004.

Thermal Spraying Powder. A thermal-spray powder includes granulated and sintered particles of an yttrium-aluminum double oxide obtained by granulating and sintering a raw powder containing yttrium and aluminum. The total volume of fine pores having a diameter of 6 μm or less in one gram of the granulated and sintered particles is 0.06 to 0.25 cm^3. The thermal-spray powder reliably forms a thermal-spray coating that is suitable for use where the thermal-spray coating is subjected to a thermal shock in a corrosive atmosphere or an oxidative atmosphere and for use where the thermal-spray coating is subjected to a thermal shock in a state where the thermal-spray coating contacts a member that reacts to a base material.

US 7279221: Junya Kitamura, Hiroaki Mizuno, and Tsuyoshi Itsukaichi. Company: Fujimi Inc. Issued/Filed: October 9, 2007/February 15, 2006.

Pre- and Post-Treatment

Method for Sealing of a Coating on a Roll. The invention relates to the method for sealing the coating and particularly an intermediate layer of a roll, particularly of a press roll such as the center roll of a press or the backup roll of an extended-nip press roll, used in a pulp, paper, board, or finishing machine, and, further, to a roll and a coating for a roll. The corrosion resistance and impermeability of the roll coating, particularly of such a coating that is made by thermal spraying, can be improved by sealing. The coating comprises a porous outermost surface layer made of a ceramic or ceramic-metal material by thermal spraying and at least one sealed layer situated between that outermost surface layer and the roll mantle.

CA 2362892: Juha Wahlroos, Kari Niemi, Bjarne Hellman, and Pentti Lehtonen. Company: Metso Paper Inc. Issued/Filed: October 16, 2007/February 15, 2000.

Spraying Systems and Methods

Metal-Forming Process. Atomized metal is deposited metal onto a substrate so as to cause at least partial solidification of the deposited metal. Further atomized metal is deposited onto the partially solidified deposited metal on the substrate; and the metal deposited onto the partially solidified deposited metal is allowed to fully solidify on the substrate. The cooling of the further deposited metal and the composition of the metal and/or of a gas used in the atomization of the further atomized metal are tailored such that volumetric contraction on solidification and cooling of the further deposited metal are compensated for, when the deposited metal has been cooled to ambient temperature, by volumetric expansion in a reaction or phase change in the further deposited metal.

CA 2200429: Allen D. Roche and Richard M. Jordan. Company: Sprayform Holdings Ltd. Issued/Filed: December 4, 2007/September 25, 1995.

Plasma Deposition Apparatus and Method for Making Solar Cells. A plasma deposition apparatus for making solar cells comprising a conveyor having a longitudinal axis for supporting at least one substrate. There are at least two modules each having at least one plasma torch for depositing a layer of a reaction product on at least one substrate, with at least one plasma torch located a distance from the at least one substrate. There is a chamber for containing the conveyor and at least two modules, and an exhaust system. In another variant, the plasma deposition apparatus for making solar cells comprises means for supporting a substrate, means for supplying reactants, plasma torch means for depositing a product on the substrate, the plasma torch means located a distance from the substrate, and means for oscillating the plasma torch means relative to the substrate.

WO 27120776: Dau Wu and Mohd A. Aslami. Company: Silica Tech, LLC. Issued/Filed: October 25, 2007/April 13, 2007.

Plasma-Spray Device. Examples relate to a plasma-spray device for spraying a powdered material, including electrodes that may form a plasma channel having an inlet end and an outlet end, and a unit for supplying the powdered material to the plasma channel. The powder supply unit may be arranged between the first section of the electrodes located upstream of the powder supply unit and the second section of the electrodes located downstream of the powder supply, as seen in the direction of plasma flow of the plasma channel.

US 7291804: Nikolay Suslov. Company: Microspray Technologies i Goteborg AB. Issued/Filed: November 6, 2007/September 17, 2003.

Powder Port Blow-Off for Thermal-Spray Processes. A powder port blow-off system for a plasma-spray process includes a faceplate that includes a bore that is coradially aligned with a nozzle of a plasma-spray gun that emits a plasma plume. A plurality of powder feed ports are arranged circumferentially around the nozzle for injecting a flow of powder particles toward the plasma plume. A plurality of powder port blow-offs are arranged circumferentially around the nozzle to direct blow-off gas across the powder feed ports. The powder port blow-offs are directed across the plasma plume to create a vortex for carrying away powder particles unconsumed by the plasma plume.

SG 136043: Thomas E. Lang and Christopher W. Strock. Company: United Technologies Corp. Issued/Filed: October 29, 2007/February 26, 2006.

Torch for Thermal Spraying of Surface Coatings and Coatings Obtained Thereby. A torch for thermal spraying of surface coatings, of the type that comprises a head and a bracket for the head, in which the head pivots relative to the bracket is presented. The invention also relates to the coatings obtained using the torch, whether of polymer, metal, or ceramic materials, on any substrate coated thereby, whether of polymer, metal, or ceramic or composite materials. The invention is applicable to different types of thermal spray torches, using plasma spray, combustion spray, high-velocity oxygen fuel (HVOF), or low-velocity processes.

WO 27116036: Nelso Antolotti, Andrea Scrivani, Michele Scartazza, and Gabriele Rizzi. Company: Turbocoating S.P.A. Issued/Filed: October 18, 2007/April 6, 2007.

Thermal Barrier Coatings and Bondcoats

Blade Tip Coatings Using High Purity Powders. This invention relates to blades for a gas turbine engine. These blades have an inner end adapted for mounting on a hub and the blade tip is located opposite in the inner end, wherein at least a portion of the blade tip has a thermally sprayed coating of a high-purity yttria or ytterbia-stabilized zirconia powder. The thermally sprayed coating has a density greater than 88% of the theoretical density with a plurality of vertical macrocracks substantially homogeneously dispersed throughout the coating in which a cross-sectional area of the coating normal to the blade tip exposes a plurality of vertical macrocracks extending to at least half the coating thickness in length up to the full thickness of the coating and having from about 5 to about 200 vertical macrocracks per linear inch measured in a line parallel to the surface of the blade tip and in a plane perpendicular to the blade tip. The high-purity yttria or ytterbia-stabilized zirconia powder comprises about 0 to about 0.15 wt.% impurity oxides, about 0 to about 2 wt.% hafnium oxide (hafnia), about 6 to about 25 wt.% yttrium oxide (yttria), or about 10 to about 36 wt.% ytterbium oxide (ytterbia), and the balance zirconium oxide (zirconia). This invention also relates to a process for producing a coating on at least a portion of a tip of a blade for a gas turbine engine.

WO 27139694: Thomas A. Taylor, Albert Feuerstein, Ann Bolcavage, Danny L. Appleby, and Neil Hitchman. Company: Praxair Technology, Inc. Issued/Filed: December 6, 2007/March 15, 2007.

Internal Combustion Engine Heat-Insulating Screen. The invention can be used for designing and manufacturing of heat-insulating screens with improved heat protection and damping properties. In the proposed heat-insulating screen, at least two holes for bolt joint are made on one axle. A chute-like projection of trapezoidal form is made along axle passing through the holes for bolt joint. Shielding surface covering exhaust manifold is single layer, with the thickness of the layer being 0.5 to 1.5 mm and provided with coating, thickness 0.02–0.50 mm, formed by gas-thermal spraying. The shielding surface has at least two stiffening ribs directed across chute-like projection to preclude deformation of surface in transverse direction. It has the effect of provision of reliable protection of parts in vehicle engine compartment against high temperatures during long temperature action, effective damping of vibrations, reduced radiated sound energy and noise.

RU 2310085: Sergerj A. Orlov and Nikolaj E. Rjabkov. Company: Zavolzhskij Motornyj ZD AOOT. Issued/Filed: November 10, 2007/December 9, 2005.

Method for Producing a Thermal Barrier Coating and Thermal Barrier Coating for a Component Part. The present invention relates to a method for producing a ceramic thermal barrier coating on a component part for use in compressor and turbine components by means of a vapor-depositing process, wherein the method comprises the following steps: (a) providing of a ceramic vapor for depositing on the component part; (b) depositing the ceramic vapor on the component part to form a thermal barrier coating of a columnar structure, the columns being oriented substantially perpendicular to a surface of the component part; and (c) varying at least one method parameter during method step (b) in such a way that the resultant thermal barrier coating comprises columns of alternating decreasing and increasing diameters (d, D). The invention also relates to a thermal barrier coating for component parts for use in compressor and turbine components, wherein the thermal barrier coating comprises a ceramic thermal barrier coating of a columnar structure and the columns are oriented substantially perpendicular to a surface of the component part. According to the invention, the columns have alternately decreasing and increasing diameters (d, D).

WO 27118439: Thomas Cosack. Company: MTU Aero Engines GmbH. Issued/Filed: October 25, 2007/March 2, 2007.

Thermal Barrier Coating System. A TBC system suitable for protecting the surface of a substrate subjected to a hostile thermal environment. The TBC system comprises a bond coat on the substrate surface, an alumina scale on the bond coat, and a multilayer TBC comprising a thermal-sprayed first ceramic layer on the alumina scale and a thermal-sprayed second ceramic layer overlying the first ceramic layer. The first ceramic layer consists essentially of partially stabilized zirconia so as to comprise the tetragonal and cubic phases of zirconia. The second ceramic layer consists essentially of fully stabilized zirconia so as to consist essentially of the cubic phase of zirconia. The second ceramic layer is also characterized by having vertical microcracks that extend through the thickness thereof. The second ceramic layer is thicker and more erosion resistant than the first ceramic layer.

US 7291403: Bangalore A. Nagaraj and Ramgopal Darolia. Company: General Electric Co. Issued/Filed: November 6, 2007/February 3, 2004.