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Selected Patents Related to Thermal Spraying

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CA denotes Canadian patent, EP denotes European patent, KR denotes Korean patent, US denotes United States patent, WO denotes World Intellectual Property Organization application. The information has the following format: Title, Abstract, Patent number, Inventors, Company, Issued/Filed dates.

Applications

Erosion-Resistant Coatings and Methods Thereof. Erosion-resistant coating processes and material improvements for line-of-sight applications. The erosion-resistant coating composition includes nanostructured grains of tungsten carbide (WC) and/or submicron-sized grains of WC embedded into a cobalt chromium (CoCr) binder matrix. A high-velocity air fuel thermal spray process (HVAF) is used to create thick coatings in excess of about 500 μm with high percentages of primary carbide for longer-life and more erosion-resistant coatings. These materials and processes are especially suited for hydroelectric turbine components.

US 7141110: D.M. Gray, K. Anand, W.A. Nelson, H. Aunemo, A. Demers, and O. Rommetveit. Company: General Electric Co. Issued/Filed: Nov 28, 2006/Dec 31, 2003.

Industrial Fabrics Having Thermally Sprayed Protective Coating. A fabric or belt and a method for forming such a fabric or belt, including a base support structure and at least one coating with the coating being applied by a thermal spray process.

WO 6113046: J. Salitsy and B.-C. Aberg. Company: Albany Intl. Corp. Issued/Filed: Oct 10, 2006/March 24, 2006.

Metal Sprayed Composite Part. A method of making an article having both a polymeric substrate and a metallic spray deposited layer is disclosed. The coefficients of thermal expansion of the polymeric substrate and the metallic layer are preferably similar.

WO 6110409: E. Aversenti and C.P. Covine. Company: GMIC, Corp. Issued/Filed: Oct 19, 2006/April 4, 2006.

Method of Preparing Metal Matrix Composite and Coating Layer and Bulk Prepared Thereby. This invention provides a method of preparing a metal matrix composite, and a coating layer and bulk prepared by using the same and in particular, it provides a method of preparing a metal matrix composite, which comprises the steps of providing a substrate; preparing a mixed powder comprising (i) a first metal powder comprising a metal, alloy, or mixture particle thereof, (ii) a second metal powder comprising an intermetallic compound forming metal particle that forms an intermetallic compound along with the metal or the alloy element of the alloy, and (iii) a ceramic powder comprising a ceramic or mixture particle thereof; injecting the mixed powder prepared above into a spray nozzle for coating; coating the mixed powder on the surface of the substrate by accelerating the mixed powder in the state of nonfusion at a speed of 300-1200 m/s by the flow of transportation gas flowing in the spray nozzle; and forming the intermetallic compound by the thermal treatment of the coated coating layer, and a coating layer and bulk prepared by using the same, whereby the coating layer and bulk material with high wear resistance and excellent resistance against fatigue crack on the surface without causing damages such as heat strain to the substrate during the preparation of the coating layer can be provided.

WO 6109956: K. Ko, H. Lee, J. Lee, J. Lee, and Young-ho Yu. Company: SNT Co., Ltd. Issued/Filed: Oct 19, 2006/April 6, 2006

Method of Preparing Wear-Resistant Coating Layer Comprising Metal Matrix Composite and Coating Layer Prepared Thereby. The invention provides a method of preparing a wear-resistant coating layer comprising metal matrix composite and a coating layer prepared by using the same, and more particularly it provides a method of preparing a wear-resistant coating layer comprising metal matrix composite, which comprises the steps of providing a base material, preparing a mixture powder comprising a metal, alloy or mixture particle thereof having an average diameter of 50-100 μm and a ceramic or mixture particle thereof having an average diameter of 25 to 50 μm in a ratio of 1:1 to 3:1 by volume, injecting the mixture powder into a spray nozzle for coating, and coating the mixture powder on the surface of the base material by accelerating the mixture powder in the state of nonfusion at a rate of 300-1200 m/s by the flow of transportation gas flowing in the nozzle and a coating layer prepared by using the same whereby the coating layer with high wear resistance and excellent resistance against fatigue crack on the surface of the base material without causing damage such as heat strain to the base material during the formation of the coating layer can be provided.

WO 6107172: K. Ko, H. Lee, J. Lee, J. Lee, and Y. Yu. Company: SNT Co., Ltd. Issued/Filed: Oct 12, 2006/April 5, 2006.

Method for Producing a Coating Containing Titanium Boride. The invention relates to a process for producing a coating having a titanium boride content of at least 80 wt.%, in which a coating having a thickness of from 0.1 to 1 mm, a porosity of not more than 10 vol.% and an oxygen content of less than 1 wt.% is applied to the surface of a substrate by plasma spraying in an atmosphere which is virtually or completely free of oxygen, with no metallic powder being added to the spraying powder.

CA 2285982: S. Sussbrich, K. Seitz, M. Hornung, F. Hiltmann, and H. Kuhn. Company: Aventis Research & Technologies GmbH & Co. KG. Issued/Filed: Dec 5, 2006/March 24, 1998.

Method for Producing Gas-Tight Layers and Layer Systems by Means of Thermal Spraying. The invention relates to a method for producing gas-tight layers and layer systems by means of a thermal spraying method. A layer is first applied by thermal spraying using a burner and is subjected to a subsequent thermal treatment by the same burner. This interruption-free method makes possible a simple and cost-effective production of gas-tight layers and layer systems having good adhesive properties. The method is particularly suited for producing fuel cell structures due to the fact that a gas-tight layer can be placed at any location in a layer system.

WO 6128424: R. Siegert, J.-E. Doring, R. Hansch, D. Stover, and R. Vassen. Company: Forschungszentrum Juelich GmbH. Issued/Filed: Dec 7, 2006/May 23, 2006.

Process for Structuring Self-Cleaning Glass Surfaces. A plasma spray process for structuring self-cleaning glass surfaces and self-cleaning glass surfaces formed according to the process. Molten or heat-softened particles of inorganic material are plasma spray deposited onto the surface of a substrate to create a microrough surface. If desired, a hydrophobic top coating layer can optionally be applied to the microrough surface. The microstructured surface formed according to the invention is durable and self-cleaning.

WO 6115558: G.E. Sakoske, M. Baumann, and E.A. Axtell. Company: Ferro Corp. Issued/Filed: Nov 2, 2006/Jan 27, 2006.

Protective Layer, Useful in Particular for Protecting Joints and/or Edges, and Process for Applying the Protective Layer. A protective layer, in particular for joints and/or edges, made of a thermoplastic material, in particular polyurethane, is disclosed for protecting objects such as transport frames, containers, packages, and parts to be protected. Also disclosed is a process for applying the protective layer. The plastics form a coating that is directly cold-injected or sprayed onto the object as a protective layer and adheres directly thereto, forming a smooth surface. The object to be protected by the coating need not be pre-treated, and therefore a complete protective layer can be achieved in a simple and fast manner, filling even corners and edges, as well as recesses, without any difficulty.

WO 6114226: R. Weinhardt. Issued/Filed: Nov 2, 2006/April 20, 2006.

Repair of Combustion Turbine Components. A method of repairing a combustion turbine component having damage located at or near a cooling hole or hollow or geometrically complex portion of the component is provided. The method comprises forming a preparatory groove that extends from a surface of the component to the damaged area, but does not extend to the cooling hole or hollow or geometrically complex portion of the component, the groove extending 40-90% the distance from the component to the damaged area; spraying a filler material into the groove with a microplasma torch at a current of less than 50 A; and filling the groove with the filler material such that the heated filler material substantially extends from the cooling hole or hollow or geometrically complex portion of the component to a surface of the component.

US 7146725: S.C. Kottilingam and P.J. Ditzel. Company: Siemens Power Generation, Inc. Issued/Filed: Dec 12. 2006/Sept 24, 2003.

Rotor for Steam Turbine and Process for Producing the Same. A rotor for steam turbine that is free from weld cracking, needs no postheat treatment, and that is improved in sliding performance of its journal part, consisting of a 9-13% Cr heat-resistant steel; and a process for producing the same. The journal part of rotor for steam turbine consisting of a 9-13% Cr heat-resistant steel at its sliding surface is provided, according to a high-speed flame thermal spraying technique, with a coating layer of low-alloy steel of $\leq 3\%$ Cr content superior in sliding performance to the 9-13% Cr heat-resistant steel wherein in arbitrary cross-section structures, the ratio of area of defects including pores and oxides is in the range of 3-15%.

WO 6134831: H. Arikawa, A. Mebata, M. Arai, Y. Kojima, and H. Toriya. Company: Hitachi, Ltd. Issued/Filed: Dec 21, 2006/June 9, 2006.

Sprayable Coating Composition. A sprayable granitelike coating composition useful for forming simulated stone surfaces, such as polished granite, such surfaces having high-impact strength, superior hardness, and an aesthetically 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: A. Ghahary and Y. Zhap. Company: Safas Corp. Issued/Filed: Dec 7, 2006/Feb 23, 2006.

Water Heater and Method of Providing the Same. An apparatus for heating fluid and a method for providing the same is provided. Generally, the system contains a metallic core, a dielectric layer thermally sprayed on the core, a resistive heater layer thermally sprayed on the dielectric layer, a metallic layer portion located at ends of the resistive heater layer, and a source of power providing said power via said metallic layer portion.

WO 6023979: R.C. Abbott, G.P. Magnant, and W.A. Glenn. Company: Thermoceramix, Inc. Issued/Filed: Dec 14, 2006/Aug 22, 2005.

Wear Resistant Ceramic Composite Coatings and Process for Production Thereof. A coated article is provided by a thermal spraying process, wherein a feedstock including an oxide ceramic and a nonoxide ceramic is deposited on a target surface of the article to provide a wear-resistant coating. The feedstock is provided by mixing carbide and/or boride ceramic powder with an oxide ceramic powder prior to thermal spraying.

WO 6111025: K. Shanker and A.G. Kraj. Company: Standard Aero Ltd. Issued/Filed: Oct 26, 2006/April, 20, 2006.

Wear Resistant Thermal Spray Coating Compound with High Electrical Conductivity and the Method Thereof. KR 639117: B.G. Seong, K.H. Baik, S.Y. Hwang, and S.R. Oh. Company: Research Institute of Industrial Science & Technology. Issued/Filed: Oct 20, 2006/Oct 12, 2005.

Diagnostics and Characterization

Methods for Preparing and Testing a Thermal Spray Coated Substrate. A method for fabricating and testing an article having a thermal spray coating thereon. The method includes providing a substrate article having a surface, thermally spraying a coating material onto the surface of the substrate article, wherein a surface of contact between the coating material and the substrate article is a bondline, and nondestructively testing the coated article. Nondestructively testing includes generating an eddy current in the coated article, measuring the eddy current in the coated article, and evaluating a near-bondline region of the coated article located adjacent to the bondline using the measured eddy current.

US 7126329: P.A. Ruzzo, M. Stewart, and A.W. Mellors. Company: General Electric Co. Issued/Filed: Oct 24, 2006/Jan 21, 2004.

Feedstock

Thermal Spray Compositions 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 includes a solid lubricant and a ceramic preferably comprising 5-60 wt.% total of the composition in a ratio of 1:7 to 20:1 of solid lubricant to ceramic, the balance a matrix-forming metal alloy selected from nickel, cobalt, copper, iron, and aluminum and combinations and alloys thereof. The solid lubricant is at least one of hexagonal boron nitride, graphite, calcium fluoride, lithium fluoride, magnesium fluoride, barium fluoride, tungsten disulfide, and molybdenum disulfide particles. The ceramic includes at least one of albite, illite, quartz, and alumina-silica.

US 7135240: P. Fiala, A.P. Chilkowich, and K. Hajmrle. Company: Sulzer Metco (Canada) Inc. Issued/Filed: Nov 14, 2006/Dec 16, 2004.

Thermal Spray Feedstock Composition. The invention relates to a thermal spray feedstock composition that employs free-flowing agglomerates formed from (a) a ceramic component that sublimes, (b) a metallic or semiconductor material that does not sublime, and (c) a binder. The invention also relates to a method for preparing the agglomerates and a method for preparing ceramic containing composite structures from the agglomerates.

WO 6104737: D.S. Gollob, T.H. Piquette, J. Derby, O.B. Al-Sabouni, R.K. Schmid, and J.C. Doesburg. Company: Sulzer Metco Venture, LLC. Issued/Filed: Oct 5, 2006/March 20, 2006.

Spraying Systems and Methods

Improved Plasma Transferred Wire Arc Thermal Spray Apparatus and Method. A plasma transferred wire arc thermal spray apparatus is described for applying a coating to a surface. The apparatus comprises a cathode having a first negative electrical potential, a nozzle generally surrounding a free end of said cathode in spaced relation having a restricted orifice opposite said cathode free end, said nozzle having a second positive electrical potential, a source of plasma gas directing plasma gas into said nozzle surrounding said cathode and exiting said restricted nozzle orifice, and a wire feed continuously directing a free end of wire feedstock opposite said restricted nozzle orifice and said wire feedstock having the same second positive electrical potential as said nozzle, said apparatus thereby establishing a plasma transferred arc between said wire feedstock free end and said cathode melting said wire feedstock free end and said plasma gas exiting said restricted nozzle orifice atomizing melted feedstock and propelling atomized melted wire feedstock toward said surface, thereby coating said surface. A method of coating a surface with a metallic coating is also disclosed.

CA 2280019: D. Cook, K. Kowalsky, J. Baughman, and D. Marantz. Company: Ford Global Technologies, Inc. Issued/Filed: Nov 21, 2006/Dec 29, 1997.

Method and Apparatus for Fine Particle Liquid Suspension Feed for Thermal Spray System and Coatings Formed Therefrom. This invention relates to a method by which liquid feedstock suspensions containing fine particles, micron- and nano-sized, are injected, with sufficient droplet velocity, preferably axially, into a thermal spray apparatus for the production of high-quality nanostructured coatings. The method allows complete entrainment of the droplets in a high-temperature gas stream, while the injection orifice remains potentially blockage-free for long periods of operation.

WO 6116844: J. Oberste-Berghaus, S. Bouaricha, J.-G. Legoux, C. Moreau, and B. Harvey. Company: National Research Council of Canada. Issued/Filed: Nov 9, 2006/April 25, 2006.

Microplasma Spray Coating Apparatus. A portable, handheld microplasma spray coating apparatus comprises an anode, a cathode, and an arc gas emitter disposed in a housing, and a powder feeding system, a cooling system, and a power source connected to the apparatus. The powder feeding system, cooling system, and power source are detachably mounted on a mobile platform. The microplasma spray apparatus can be transported to on-site locations in the field to facilitate quick repair work.

US 7115832: D.R. Blankenship, G. Shubert, and P.H. Zajchowski. Company: United Technologies Corp. Issued/Filed: Oct 3, 2006/July 26, 2005.

Process for Obtaining a Flexible/Adaptive Thermal Barrier. The invention proposes a process for obtaining a flexible/adaptive thermal barrier, the thermal barrier comprising a ceramic layer deposited on a substrate covered with a sublayer, the ceramic layer being deposited by thermal spraying using a torch. The ceramic layer is deposited in a single pass, and the torch is set to give the ceramic layer a thickness of at least 80 μm. Such a process is noteworthy in that: (a) the ceramic layer is deposited in a single pass and (b) the torch is set to give the ceramic layer a thickness of at least 80 μm.

US 7144602: P. Bengtsson and L.P. Dudon. Company: Snecma Moteurs. Issued/Filed: Dec 5, 2006/May 17, 2004.

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

EP 1245692: J.A. Bauer, G.F. Dailey, M.W. Fischer, D.O. Willaman, and M.J. Metala. Company: Siemens Power Generation, Inc. Issued/Filed: Nov 29, 2006/Aug 13, 2001.

Thermal Barrier Coatings and Bondcoats

Bilayer HVOF Coating with Controlled Porosity for Use in Thermal Barrier Coatings. A bilayer bond coating for use on metal alloy components exposed to hostile thermal and chemical environment, such as a gas turbine engine, and the method for applying such coatings. The preferred coatings include a bilayer bond coat applied to the metal substrate using high-velocity oxyfuel (HVOF) thermal spraying. Bilayer bond coatings in accordance with the invention consist of a dense first inner layer (such as iron, nickel or cobalt-base alloys) that provides oxidation protection to the metal substrate, and a second outer layer having controlled porosity that tends to promote roughness, mechanical compliance, and promotes adherence of the thermal barrier coating (TBC). Preferably, the outer, less dense layer of the bilayer bond coat is formed from a mixture of metallic powder and polyester to adjust and control the porosity, but without sacrificing mechanical compliance.

US 7150921: W.A. Nelson, J.C. Schaeffer, S.T. Swede, D.V. Bucci, J. Debarro, T.H. Strout, and T.R. Mortensen. Company: General Electric Co. Issued/Filed: Dec 19, 2006/May 18, 2004.

Method of Forming Stabilized Plasma Sprayed Thermal Barrier Coatings. A method for stabilizing a porous thermal barrier coating plasma sprayed on a substrate comprises the steps of immersing the porous thermal barrier coating in a sol-gel comprising a metal oxide or precursor thereof, a solvent, and a surfactant, applying vacuum pressure to the sol-gel to infiltrate the porous thermal barrier coating with the sol-gel, and drying the sol-gel to produce residual metal oxide particles in the porous thermal barrier coating.

WO 6137890: D. Raybould, P. Chipko, and T.E. Strangman. Company: Honeywell Intl. Inc. Issued/Filed: Dec 28, 2006/Sept 27, 2005.

Thermal Barrier Coating Containing Reactive Protective Materials and Method for Preparing Same. A thermal barrier coating for an underlying metal substrate of articles that operate at, or are exposed, to high temperatures, as well as being exposed to environmental contaminant compositions. This coating comprises an inner layer nearest to the underlying metal substrate comprising a ceramic thermal barrier coating material, as well as an outer layer having an exposed surface and comprising a CMAS-reactive material in an amount up to 100% and sufficient to protect the thermal barrier coating at least partially against CMAS (mixed calcium-magnesium-aluminum-silicon-oxides, Ca-Mg-Al-Si-O) that becomes deposited on the exposed surface, the CMAS-reactive material comprising an alkaline earth aluminate or alkaline earth aluminosilicate where the alkaline earth is selected from barium, strontium, and mixtures thereof, and optionally a ceramic thermal barrier coating material. This coating can be used to provide a thermally protected article having a metal substrate and optionally a bond coat layer adjacent to and overlaying the metal substrate. The thermal barrier coating can be prepared by forming the inner layer of the ceramic thermal barrier coating material, followed by depositing the CMAS-reactive material, or codeposition the CMAS-reactive material and the ceramic thermal barrier coating material, to form the outer layer.

EP 1428901: B.A. Nagaraj and I. Spitsberg. Company: General Electric Co. Issued/Filed: Nov 22, 2006/Oct 9, 2003.

Thermal Barrier Coating Protected by Thermally Glazed Layer and Method for Preparing Same. A thermal barrier coating for an underlying metal substrate of articles that operate at, or are exposed, to high temperatures, as well as being exposed to environmental contaminan compositions. This coating comprises an inner layer nearest to the underlying metal substrate comprising a ceramic thermal barrier coating material having a melting point of at least about 1093 °C (2000 °F), as well as a thermally glazed outer layer having an exposed surface and a thickness up to 0.4 mils (about 10 μm) and sufficient to at least partially protect the thermal barrier coating against environmental contaminants that become deposited on the exposed surface, and comprising a thermally glazable coating material having a melting point of at least about 1093 °C (2000 °F) in an amount up to 100%. This coating can be used to provide a thermally protected article having a metal substrate and optionally a bond-coated layer adjacent to and overlaying the metal substrate. The thermal barrier coating can be prepared by forming the inner layer comprising the ceramic thermal barrier coating material, followed by depositing the thermally glazable coating material on the inner layer, and then thermally melting the thermally glazable coating material to form the thermally glazed outer layer.

EP 1428908: B.A. Nagaraj, T.J. Rockstroh, B.A. Boutwell, and W.D. Scheidt. Company: General Electric Co. Issued/Filed: Nov 22, 2006/Oct 7, 2003.