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Selected Patents Related to Thermal Spraying

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Applications

Alumina-Zirconia Materials and Methods of Making the Same. Alumina-zirconia materials and methods of making the same. Embodiments of the invention include abrasive particles. The abrasive particles can be incorporated into a variety of abrasive articles, including bonded abrasives, coated abrasives, nonwoven abrasives, and abrasive brushes.

US 7101819: A.Z. Rosenflanz, A. Celikkaya, and T.J. Anderson. Company: 3 M Innovative Properties Co. Issued/Filed: Sept 5, 2006/Aug 2, 2002.

Biocompatible Thermal Spray Coating made from a Nanostructured Feedstock. A method of making a biocompatible coating for an implant involves thermally spraying a feedstock of nanostructured agglomerated particles of a biocompatible material onto a substrate and controlling the spray parameters such that the agglomerated particles strike the substrate as a mix of fully molten and semimolten particles and the semimolten particles become distributed throughout the coating.

WO 6092041: R.S. Lima, B.R. Marple, H. Li, and K.A. Khor. Company: National Research Council of Canada, Nanyang Technological University. Issued/Filed: Sept 8, 2006/Feb 27, 2006.

Coated Member, Especially Roller, Made of Carbon Fiber-Reinforced Plastic (CFK) for Paper Machines and printing Presses, and Method for the Production of Such a Member. The invention relates to a coated member, especially a roller, made of carbon fiber-reinforced plastic (CFK) for paper machines and printing presses. Said coated member comprises an adhesive layer and a wear-resistant hard metal or oxide ceramic layer that is applied to the adhesive layer. The inventive coated member is characterized in that the adhesive layer is made of ductile metal, which is selected among the group encompassing copper, nickel, iron, lead, and tin and is applied using plasma spraying or flame spraying. The invention further relates to a method for producing a coated member made of carbon fiber-reinforced plastic (CFK) for paper machines and printing presses, particularly a roller. According to said method, an adhesive layer made of a ductile material that is selected among the group comprising copper, nickel, iron, lead, and tin is applied to a CFK member by means of plasma spraying or flame spraying while the member is maintained at a temperature not exceeding 200 °C with the aid of cooling measures. In another step, a wear-resistant hard metal or oxide ceramic layer is applied to the adhesive layer.

WO 6089519: G. Johner and M. Kirst. Company: Coatec Gesselschaft fur Oberflachenveredelung. Issued/Filed: Aug 31, 2006/Feb 16, 2006.

Connector Component for Multicore Optical Fiber, Ferrule, and Method for Manufacturing the Same. The objective is to offer a connector component for multicore optical fiber, or an assembly of ferrules, having high-precision ferrules in concentricity, circularity, axial linearity, and spacing distance, as well as to offer a method of manufacturing the same at a reduced cost. The connector (or ferrules) is featured by its manufacturing method including thermal spraying or electroforming is applied, using a resin or a metal, to a plurality of cylinder-shaped ferrules, under the condition that projections which are positioned opposite each other of a positioning member are fitted and nipped to both ends of insertion holes of the cylinder-shaped ferrules so that each ferrule is properly positioned and the central axes are parallel to each other at specified positions so that the plurality of cylinder-shaped ferrules are coated.

US 7083332: T. Mukouda. Issued/Filed: Aug 1, 2006/Aug 13, 2001.

Cooking Surface. A cooking surface has a thickness that is decided by a compromise between the highest efficiency, the lowest magnetic stray field, and the desired surface material. In the thickness range 0.05-0.2 mm the top layer consists of plasma sprayed hard ceramic such as alumina, possibly impregnated with polytetrafluorethylene. In the thickness range 0.2-2 mm the top layer may consist of a glass fiber reinforced material possibly impregnated with polytetrafluorethylene, possibly of a hardened quality, and in the thickness range 1.00-3.00 mm the top layer may consist of a vitroceramic or glass material. Scratch resistance and cleanability are combined with an elevated efficiency.

EP 819366: J.E. Dahl and T.F. Pedersen. Company: AB Electrolux. Issued/Filed: Sept 13, 2006/April 9, 1996.

Golf Club with a Thermally Sprayed Coating. Golf club with thermally sprayed layer on striking face. A golf club has a thermally sprayed layer in its striking face region. Preferred features: The layer is a flame sprayed or cold gas sprayed coating of metal, metal alloy, oxide, carbide, boride and/or plastic, especially a metallic coating containing carbides.

EP 925810: P. Heinrich and H. Kreye. Company: Linde AG. Issued/Filed: July 5, 2006/Dec 8, 1998.

Heat Exchanger Member and Production Method Thereof. In some embodiments of the invention, a heat-exchanger member high in corrosion resistance and excellent in brazing performance can be stably produced at low cost. A production method of a heat-exchanger member to be brazed comprises the step of spraying particulate powder of metal less noble in corrosion potential than Al, an alloy of the metal or a composition of the metal at 150 °C or less at high speed onto a surface of a substrate of aluminum or its alloy to thereby make the particulate powder adhere to the surface. The metal is diffused in the surface layer portion of the substrate by the brazing heating to form a sacrificial corrosive layer.

WO 6088233: K. Minami and I. Iwai. Company: Showa Denko K.K. Issued/Filed: Aug 24, 2006/Feb 16, 2006.

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 7081376: 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: July 25, 2006/Oct 25, 2004.

Method of Coating a Pipe Element or Device used to Convey Gaseous Oxygen. The invention relates to a method of producing a device or an element belonging to a piece of equipment that is made from steel or a steel alloy, which may come into contact with pressurized oxygen during the use thereof. The inventive method consists in producing a coating by thermally spraying a spray material that is selected from among nickel and the alloys of copper and nickel on at least part of the surface of the element or device, such as to obtain at least one coating layer on said surface, having a thickness of less than or equal to 5 mm.

WO 6092516: A. Colson and E. Fano. Company: L'Air Liquide S.A. Issued/Filed: Sept 8, 2006/Feb 13, 2006.

Method for Generation of Antiwear Protective Layers on Piston Rings and a Piston Ring Provided with an Antiwear Layer. The invention relates to a method for the production of antiwear protective layers on a piston ring base body made from steel or cast iron, whereby firstly the friction area region is provided at least partly with an at least single-layered thermal sprayed layer made from nitrogen-refined metallic elements in such a form that the spray layer has a porosity in the region of 3-10%, and subsequently at least the edges and the friction area region including the spray layer applied thereto are subjected to a nitriding process.

WO 6097057: S. Hoppe, V. Scherer, and M. Buchmann. Company: Federal-Mogul Burscheid GmBH. Issued/Filed: Sept 21, 2006/Jan 12, 2006.

Method of Making Erosion-Resistant Heat-Protective Coats. Proposed method may be used in rocketry in manufacture of combustion chambers for liquid propellant engines with cermet erosion-resistant heat-protective coats on base of ZrO_2 NiCr composition. Proposed method includes spraying of nichrome precoat followed by spraying of cermet composition from mechanical powder mixture containing 50-80 wt% of zirconium dioxide and 50-20 wt% of nichrome. For spraying cermet composition, use is made of mechanical mixture containing zirconium dioxide and nichrome powders at size of particles of 10-40 μm and 40-100 μm, respectively. Powder mixture is delivered under nozzle exit section of plasmatron in way of its motion relative to surface to be coated. Calcium oxide is used as stabilizing additive in zirconium dioxide powder in the amount of 4-6 wt%. Effect: increase of adhesion strength by two to three times; enhanced heat resistance of cermet coats due to phase transition from metal precoat to main coat.

RU 2283363: S.V. Valentinovich, V.V. Petrovich, Z.N. Ivanovna, Z.E. Fedorovich, K.V. Ivanovich, K.A. Petrovich, P.S. Vladimirovich, S.F. Vasil'evich, and Ch.I. Germanovich. Company: OAO "Kompozit." Issued/Filed: Sept 10, 2006/July 15, 2003.

Method of Manufacturing Electromagnetic Devices Using Kinetic Spray. A method of manufacturing electric machines comprises geometrically patterned arrays of permanent magnets, soft magnetic materials, and electrical conductors deposited by kinetic spraying methods directly atop a carrier. The magnets and planar coils of the present invention may be integrally formed atop carriers to form electrical machines such as motors, generators, alternators, solenoids, and actuators. The manufacturing techniques used in this invention may produce highly defined articles that do not require additional shaping or attaching steps. Very high-purity permanent and soft magnetic materials, and conductors with low oxidation are produced.

US 7097885: F. Leonardi, J.M. Ginder, and R.C. McCune. Company: Ford Global Technologies, LLC. Issued/Filed: Aug 29, 2006/June 17, 2003.

Method for Preparing by Thermal Spraying a Silicon- and Zirconium-Based Target. The invention concerns a method for preparing a thermal projection, in particular with plasma, a target, said target comprising at least one compound based on atoms of a different type selected in particular among constituents M belonging to the family (Zr, Mo, Ti, Nb, Ta, Hf, Cr) and silicon. The invention is characterized in that it consists of injecting at least one fraction of said compound whereof the constituents are bound by covalent and/or ionic and/or metallic bonds in a plasma propellant, said plasma propellant spraying the constituents of said compound on the target so as to obtain a deposition of said compound at a portion of the surface of said target.

WO 6085020: N. Nadaud and D. Billieres. Company: Saint-Gobain Glass France. Issued/Filed: Aug 17, 2006/Feb 3, 2006.

Method of Producing Metal Article Having Internal Passage Coated with a Ceramic Coating. The present application relates to a method of producing a metal article having an internal passage coated with a ceramic coating. The method comprises: preparing a core for defining the internal passage, applying the ceramic coating on the core, assembling the core with the ceramic coating applied thereon into a mold, casting metal into the mold at a pour temperature lower than the melting temperature of the ceramic coating, and removing the core. The ceramic coating may be applied by plasma spraying or slurry deposition.

WO 6085995: U.K. Schuelke and T.E. Strangman. Company: Honeywell International, Inc. Issued/Filed: Aug 17, 2006/July 19, 2005.

X-Ray Tube and Method of Manufacture. The present invention is directed to an air-cooled radiographic apparatus, and its method of manufacture, that utilizes a single integral housing for providing an evacuated envelope for an anode and cathode assembly. The integral housing is preferably formed from a substrate material that has a radiation shielding layer comprising a powder metal that is deposited with a plasma spray process. The powder metal includes, for example, tungsten and iron, so that the radiation shield layer provides sufficient radiation blocking and heat transfer characteristics such that an additional external housing is not required. In one alternative embodiment, the integral housing is composed of a solidified, integrated mixture of metallic powders

that function together as both the integral housing wall and the radiation shielding. In another alternative embodiment, chromium is intermixed into the mixture of metallic powders to form a thermally emissive surface upon firing the housing in a wet hydrogen environment.

US 7079624: R.S. Miller, D.L. Salmon, and C.F. Artig. Company: Varian Medical Systems, Inc. Issued/Filed: July 18, 2006/Dec 12, 2002.

Diagnostics and Characterization

Thermal Spraying Apparatus. Instrument to control a thermal projection torch in real time by measuring the jet characteristics by a combined camera and pyrometer and computer analysis to determine the required feed parameter.

EP 1340579: M. Vardelle, C. Boussoutrot, H. Hoffmann, T. Renault, and F. Braillard. Company: Snecma Services. Issued/Filed: Aug 16, 2006/Feb 28, 2003.

Feedstock

Composite Powder for Gas Thermal Coats. Proposed composition may be used as powder or cord materials made on base of this powder. Proposed composite powder contains chromium carbide particles clad with nickel and particles consisting of core of chromium carbide Cr_3C_2, which is coated with layer of chromium carbide Cr_7C_3 and layer of chromium carbide $(Cr,Ni)_7C_3$ modified with nickel at the following ratio of components, mass%: $(Cr,Ni)_7C_3$, 0.5-4.6; chromium carbide Cr_7C_3, 0.8-5.4; the remainder being chromium carbide Cr_3C_2, up to 100; ratio of nickel to chromium carbide particles is equal to, mass%: nickel, 16.2-22.2; chromium carbide particles, 77.8 to 83.8. Proposed powder possesses high microhardness, high degree of spheroidizing of particles and low porosity. Effect: enhanced density, high adhesion, and wear resistance.

RU 2279495: Zh.V. Aleksandrovich, T.T. Afanasjeva, and R.N. Aleksandrovna. Issued/Filed: July 10, 2006/Aug 24, 2004.

Hollow Thermal Spray Electrode Wire Having Multiple Layers. An electrode wire for use in a thermal spray process. The electrode wire is formed with a first layer of a first material formed as tubular outer layer and a second layer of a second material, different from the first material, formed as a tubular inner layer located inside the tubular outer layer. The tubular inner layer includes in an outer surface, which is located in substantially uniform contact at an interface with an inner surface of the tubular outer layer. The interface between the inner and outer layers is defined by a mechanical bond between the materials of the inner and outer layers. In a method of performing a thermal spray process the electrode wire is caused to vaporize and spray on a substrate surface to form a bondcoat on the substrate surface.

US 7094987: D.M. Stager. Company: Select-Arc, Inc. Issued/Filed: Aug 22, 2006/April 19, 2005.

Metal Powder for Thermal Application of Coats on Substrates. Metal powder contains particles of preliminarily alloyed main iron powder containing in its turn molybdenum particles added to main powder particles by diffusion alloying. Molybdenum particles are obtained from reduced molybdenum trioxide. Amount of molybdenum introduced into main powder particles by diffusion alloying exceeds 2 mass%, preferably 3 mass% and more preferably 4 mass% in terms of mass of metal powder. Specification describes application of this powder. Effect: ability of powder to deposition; improved quality of coats; avoidance of segregation of powder; low content of molybdenum.

RU 2280708: H. Ulf and H. Hans. Company: Hoeganaes AB. Issued/Filed: July 27, 2006/May 17, 2002.

Powder Thermal Spray Compositions. The present invention relates to a powder thermal spray composition having a thermoset material and a thermoplastic material. The thermal spray compositions may also include phosphorescent materials to allow the substrate to glow in the dark when applied and/or antimicrobial materials to retard microbial growth on surfaces to which it is applied. The present invention also relates to zinc plastic thermal spray compositions used to coat surfaces, such as steel, to more effectively bond thermal spray compositions and to prevent corrosion of the steel.

WO 6076341: F.N. Longo and T. Gardega. Company: Xiom Corp. Issued/Filed: July 20, 2006/Jan 10, 2006.

Processes for Forming Nanoparticles. In a first aspect, the process includes utilizing a precursor medium comprising particles and a nongaseous precursor to form product nanoparticles having a core/shell structure. In another aspect, the process includes utilizing an emulsion precursor medium comprising a nongaseous precursor and two liquid vehicles, wherein one of the liquid vehicles provides desirable thermal effects upon combustion. In another aspect the flame spray process includes modifying solid particles in a flame spray process to change the phase thereof.

WO 6078825: T.T. Kodas, G.P. Fotou, M. Oljaca, N.J. Hardman, and P. Kumar. Company: Cabot Corp. Issued/Filed: July 27, 2006/Jan 20, 2006.

Pretreatment and Posttreatment

Coating Method and Covering for Removing Overspray Adherences. The invention relates to a coating method wherein partial areas of a surface of a substrate are coated by thermal spraying. Said method comprises the following steps: (1) the substrate is coated in the partial areas that are provided for coating, whereby, at least one partial area that is not provided for the coating accumulates the overspray adherences; (2) the coating is covered, in the partial area (good layer) which is provided for the coating, with a covering; (3) the overspray adherences are removed in the partial areas that are not provided for the covering and that are not covered with a cover, by means of a particle beam method for removing material. The danger of disturbing overspray adherences during thermal spraying is at least reduced during said coating method. For step 3, a covering is provided that can be arranged over the good layer, such that the good layer is protected by a particle beam when the overspray adherences are removed. Step 3 can be carried out in a simple manner with the covering. The invention also relates to a maintaining device for said type of covering.

WO 6074961: O. Bihlmaier, J. Richter, D. Schilling, and N. Vocino. Company: DaimlerChrysler AG. Issued/Filed: July 20, 2006/Jan 16, 2006.

Method for Surface Treatment of the Interiors of Engine Cylinder Bores, and Cylinders Made by Said Method. A method for surface treatment of the interiors of hollow bodies, especially cylinder bores, in preparation for the application of a thermally sprayed layer.

The method comprises dry cutting without a lubricant or with a shortage of lubricant using a tool having a defined and/or undefined surface profile. In this method, a portion of the material forming the interior is removed and produces a surface that has a defined structure and/or quality. This eliminates the need for costly degreasing of the surface following machining.

US 7089662: P. Izquierdo, K.-H. Kaiserauer, M. Lahres, and O. Storz. Company: DaimlerChrysler AG. Issued/Filed: Aug 15, 2006/Oct 14, 2004.

Thermal Spraying on Machine Parts. Proposed method consists of spraying layer of coat material, heat treatment of coat material, and spraying of additional layers of the same coat material. Each additional layer is subjected to heat treatment forming necks at points of contact of particles. Coat thus obtained has porosity from 1 to 15 vol.%. Part coated by this method is proposed. Effect: enhanced wear resistance of part, enhanced impact viscosity, corrosion resistance, heat resistance, and plasticity.

RU 2281983: M. Lekh and B. Michael. Company: MAN B&V Diesel A/S. Issued/Filed: Aug 20, 2006/Feb 28, 2002.

Densification of Thermal Spray Coatings. A thermal spray mixed with a substrate using a nonconsumable cylindrical rotating tool. The process may be repeated to create a compositelike coating or material. The coating or material may be machined to improve surface quality.

US 7105205: C. Clayton, H. Herman, and H. White. Company: Research Foundation of the State of New York. Issued/Filed: Sept 12, 2006/March 29, 2004.

Spraying Systems and Methods

A Thermal Spraying Method and Device. A thermal spraying device, comprising a means for generating a flame and a means for injecting a powder into the flame, said flame-generating means comprising an end piece out of an outlet of which the flame is directed toward a substrate subjected to spraying, and the powder-injection means comprising a frame element that projects in the flame ejection direction from the end piece, that at least partly surrounds a flame zone extending from the end piece, and that presents an inner circumference that is larger than the inner circumference of said outlet, and at least one powder port for the introduction of a powder to the flame being arranged on the inner periphery of said frame element at a distance from the outlet of the end piece as seen in the flame ejection direction. There is provided at least one gas injection opening in the frame element, said gas injection opening being located between the outlet of the end piece and the at least one powder port as seen in the flame ejection direction.

WO 6080870: J. Wigren, J. Johansson, S. Bjorklund, and I. Choquet. Company: Volvo Aero Corp. Issued/Filed: Aug 3, 2006/Jan 26, 2005.

Method and Apparatus for Producing a Coating on a Substrate. The invention relates to the use of an atomizer to inject a coating material typically in the form of a liquid/solid particulate slurry into a subatmospheric pressure plasma to generate a high flux of excited coating forming material that permits the rapid deposition of a composite coating onto a substrate. The use of plasma discharges at reduced pressures results in the more efficient consumption of process precursors and gases, a reduced risk of explosion compared to atmospheric pressure processes, and facilitates the removal of volatile components from the deposited composite coatings prior to their use.

WO 6092614: J.P.S. Badyal and L.J. Ward. Company: University of Durham. Issued/Filed: Sept 8, 2006/March 3, 2006.

Method of Plasma Spraying of Coats. Coat is formed by flow of particles due to spraying of rod material molten in plasma jet. Spraying of part of rod material is performed by imparting ultrasonic oscillations to it. Current of plasmatron arc and distance between axis section of nozzle and axis of rod material are equal to (120-150 A and 10-15 mm, respectively. Rate of delivery of rod material to plasma jet depends on condition of inverse ratio of rate of spreading of molten material front and retaining of layer of melt on end face of rod material that does not exceed half length of standing wave of ultrasonic oscillations. Article to be coated is subjected to ultrasonic oscillations in required direction, thus ensuring continuous control of properties of coat from inner layers to outer ones. Effect: enhanced adhesion-cohesion properties of coats; improved quality of articles.

RU 2283364: B.N. Valer'evich, L.V. Nikolaevich, and T.D. Viktorovich. Company: Saratovskij Gosudarstvennyj Tekhnicheskij Universitet (SGTU). Issued/Filed: Sept 10, 2006/Nov 9, 2004.

Thermal Barrier Coatings and Bondcoats

Method of Protecting Titanium Alloys Against High Temperatures and Material Thus Obtained. The invention relates to a method of obtaining a cermet coating comprising particles of chromium carbide embedded in a nickel/chromium matrix, obtained by means of thermal projection on titanium alloys, which prevents oxidation and the diffusion of oxygen therein at temperatures up to 700 °C. In addition, a ceramic layer is deposited on the cermet coating and serves as a thermal barrier.

WO 6084925: E.E. Bilbao, S.A. Nieto, E.S. Fernandez, and G. Barykin. Company: Fundacion INASMET. Issued/Filed: Aug 17, 2006/Feb 11, 2005.