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Selected Patents Related to Thermal Spraying

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CA denotes Canadian patent, CN denotes Chinese 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

Amorphous-Metal Composite Material, Process for Producing the Same, and Article Obtained by the Same. An amorphous-metal composite material comprises a base and an amorphous metal superposed on and united with a surface of the base. It is obtained by uniting a layer of the amorphous metal to the surface of a base which has been regulated beforehand so as to have elasticity in the same region as that of the amorphous metal. The amorphous metal can thus be stopped from peeling off. Consequently, the mechanical strength of the amorphous metal can be added to the mechanical strength inherent in the base. By regulating the thickness of the amorphous metal, mechanical properties of the amorphous-metal composite material, such as mechanical strength and Young's modulus, can be controlled. The amorphous-metal composite material can be obtained by layer superposition and thermal spraying; this enables even an article of complicated shape to be easily formed.

WO 27105738: M. Norio, J. Kawakita, S. Hiromoto, A. Yamamoto, and S. Kuroda. Company: National Institute for Materials Science. Issued/Filed: September 20, 2007/March 13, 2007.

Electrostatic Chuck and Production Method Therefor. The present invention provides an electrostatic chuck comprising a substrate, a dielectric layer formed by thermal spraying on an upper face of the substrate, an internal electrode embedded in the dielectric layer, a feeder terminal portion extending from the lower face of the substrate to the internal electrode, and an electrode provided in the feeder terminal portion, wherein the feeder terminal portion and the substrate are fixed to each other by mechanical joining.

US 7265962: S. Miyaji, X. Chen, and S. Saito. Company: NHK Spring Co., Ltd. Issued/Filed: September 4, 2007/April 1, 2004.

Metal-Impregnated Graphite Composite Tooling. A metallic shell used, for example as a mold, is formed by spray deposition of metallic layers over nonmetallic layers as, for example, a reinforcing fabric.

US 7270167: E. Aversenti and A. Solomon. Company: GMIC Corp. Issued/Filed: September 18, 2007/December 3, 2004.

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

US 7250194: E. Aversenti and C.P. Covino. Company: GMIC, Corp. Issued/Filed: July 31, 2007/April 7, 2005.

Method of Controlling Pore Configuration of Porous Metal. The pore size, porosity, pore distribution, and so forth of porous metal are controlled by plasma spraying on the surface of the porous metal.

WO 27096957: K. Taguchi, A. Mizuta, K. Ishida, Y. Matsuzaki, S. Nagatome, H. Nakajima, and S.-K. Hyun. Company: Kawasaki Jukogyo Kabushiki KaishaOsaka University. Issued/Filed: August 30, 2007/February 22, 2006.

Method of Forming Metal Foams by Cold Spray Technique. The present invention relates to the method of forming metallic foams using cold-spray processing. The method allows for the formation of metallic foams on existing substrates as a layer. It includes providing a substrate for coating a metallic foam, cold spraying a mixture of metal particles and a foaming agent onto the substrate to form a substrate coated with an unexpanded metallic layer, foam heat treating the substrate coated with an unexpanded metallic layer at a temperature above the decomposition temperature of the foaming agent for a time sufficient to form a heated substrate coated with an expanded metal foam layer, and cooling the heated substrate coated with an expanded metal foam layer to about ambient temperature to form a cooled substrate coated with an expanded metal foam layer. The method of forming metallic foams on substrates finds application in the oil, gas, and chemical industries by being an integral part of casings, pipelines, transfer lines, and other flow lines.

WO 27092218: R. Ayer and N. Pokutylowicz. Company: ExxonMobil Research and Engineering Co. Issued/Filed: August 16, 2007/January 30, 2007.

Method of Manufacturing Electromagnetic Devices Using Kinetic Spray. A method of manufacturing electric machines comprising geometrically patterned arrays of permanent magnets, soft magnetic materials, and electrical conductors deposited by kinetic spraying methods directly atop a carrier is presented. The magnets and planar coils of the present invention may be integrally formed atop carriers to form electric 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 7244512: J. Ginder, R. McCune, and F. Leonardi. Company: Ford Global Technologies, LLC. Issued/Filed: July 17, 2007/February 6, 2004.

Plasma-Spraying Method for Improving Fatigue Performance of Welded Structure. The invention presents a plasma-spraying method for improving the endurance feature of welded structures, applied to a plasma-spraying process by spraying a coat on the surface of a brazing seam, and comprises the following steps: (i) grit blasting in the brazing seam of the specimen, (ii) plasma-spraying bound substratum on the surface of the brazing seam for 0.03

to 0.07 mm thickness, the materials of which are selected form Ni/AL, Ni/Cr, or MCrAlY, wherein a M is a transient metal such as Fe, Ni, Co, or NiCo, (iii) spraying plasma powder on the brazing seam surface as a face coat for 0.8 to 1.2 mm in thickness. The invention improves the endurance feature of the welded structure in such a way that by plasma spraying coats of a low-elasticity modulus in the weld joint, with which the shape of the cross section can be improved, the stress concentration there can be lowered, and the endurance strength of the welded structure can be advanced, and (iv) compared with the welding specimen, the endurance strength of the invented plasma-spraying specimen increases by 25.9%, while the flame-spraying specimen increases by only 9.7%.

CN 1324160: H.L. Wang. Company: Univ. Tianjin. Issued/Filed: July 4, 2007/April 7, 2005.

Process for the Repair and Restoration of Dynamically Stressed Components Comprising Aluminum Alloys for Aircraft Applications. The present invention relates to the process of the repair and restoration of dynamically stressed components comprising aluminum alloys for aircraft applications, in which: (a) the base material from which the component to be repaired was manufactured is determined, (b) the component to be repaired is, if necessary, subjected to pretreatment, (c) a spray material that has chemical, physical, and mechanical properties comparable to those of the base material is selected, (d) coating parameters for the subsequent coating process are selected so that bonding within the layer to be applied is optimized, (e) the spray material is applied to the component to be repaired by means of cold gas spraying to replace material that has been removed by wear and pretreatment, and (f) the coating component is after-treated in such a way that the original component geometry is restored. This process allows components for use in aircraft to be restored following additional process steps, in particular thermal process steps such as sintering, which is necessary for this purpose.

WO 27098885: T. Stoltenhoff, F. Zimmermann, K. Goerris, and H. Burger. Company: Praxair Surface Technologies GmBH, Roeder Praezision GmBH. Issued/Filed: September 7, 2007/February 22, 2007.

Spray-Formed Articles Made of Pseudo-Alloy and the Method for Making the Same. Method and arrangement for spray forming an article. The method includes spraying a plurality of metal streams upon a low-heat-resistant model and thereby forming a spray-formed article. Each of the plurality of metal streams is composed of moltenized droplets, and as for the plurality of metal streams, each is composed of different constituent elements. In the spray-form process, conditions of the metal streams are controlled, particularly around the time that the droplets land, to prevent adverse affects such as melting or burning the master model. The spray conditions are controlled in such a manner that the individual metal droplets forming the metal streams remain substantially segregated. The segregated state is maintained throughout solidification so that the resulting spray formed article is composed of at least partially a pseudo-alloy.

US 7273669: G. Grinberg, M.M. Shade, D.R. Collins, and R.L. Allor. Company: Ford Global Technologies, LLC. Issued/Filed: September 25, 2007/July 10, 2003.

Turbine Component Crack Repair Using Cathodic Arc and/or Low-Pressure Plasma Spraying and HIP. A method for repairing cracks in a metal part comprises the steps of providing a metal part having a crack, cleaning the crack to remove an oxide layer, depositing a repair alloy via at least one of the cathodic arc depositions and low-pressure plasma spraying to cover the crack, and heating the part at a temperature and pressure sufficient to close the crack.

US 7259350: M. Minor, C. Bischof, H. Koven, and P. Pellet. Company: United Technologies Corporation. Issued/Filed: August 21, 2007/August 26, 2004.

Wear Monitoring System with Embedded Conductors. Aspects of the invention relate to a system for monitoring the wear of a component. A conductor can be embedded in the component at a depth from a surface of the component. In one form, the conductor can be operatively connected to a power source to form an electrical circuit. The resistance across the conductor can be measured. As the component contacts a second component, the component can begin to wear. Once the wear progresses to the conductor, changes in the measured resistance can result. Thus, an operator can be alerted that the component has worn out to a certain point and that service may be needed. Alternatively, impedance can be measured across the conductor. Because the dielectric permeability of the material surrounding the conductor can affect impedance, changes in impedance can occur as the surface material of the component is worn out.

US 7270890: S.M. Sabol and R. Subramanian. Company: Siemens Power Generation, Inc. Issued/Filed: September 18, 2007/December 20, 2004.

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 is 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.

US 7256369: M. Seitz. Issued/Filed: August 14, 2007/May 27, 2004.

Material in Powder or Wire Form on a Nickel Basis for a Coating and Processes and Uses Therefor. A material in powder or wire form on a nickel basis for the production of a coating with a high level of resistance to corrosion and wear by means of a thermal-coating process is of the following composition (wt.%): C 0.005-1.0; Cr 10.0-26.0; Mo 8.0-20.0; Fe 0.1-10.0; Si 3.0-7.0; B 1.0-4.0; Cu 0.1-5.0; Ni balance. The material in the powder form can be alloyed and sprayed out of the melt or agglomerated out of different alloyed and nonalloyed metal powders. The coating material can also be used in the form of a filling wire or an alloyed and cast bar material.

CA 2208647: P. Heimgartner, I. Kretschmer, and G.R. Heath. Company: Castolin S.A. Issued/Filed: August 14, 2007/June 24, 1997.

Powder Thermal Spray Compositions Composing at Least Two Thermoplastics. A thermal spray-coating composition comprising up to about 90 wt.%

of the composition of the first thermoplastic material and up to about 50 wt.% of the composition of at least one additional thermoplastic material that is different from the first thermoplastic material is presented. Additional components can be added to the empirical compositions to improve additional secondary properties.

WO 27089620: F.N. Longo and T. Gardega. Company: Xiom Corp. Issued/Filed: August 9, 2007/January 25, 2007.

Sprayable Composition. The present invention provides a sprayable composition comprising a ceramic particulate, including albite, illite, and quartz; and a metallic composition, including nickel, chromium, iron, and silicon. The sprayable composition may be a composite particle, a blend, or a cored wire. The present invention further provides an abradable coating formed on a metal substrate according to a method that involves depositing the abradable coating on the metal substrate by thermal spraying of a sprayable composition comprising a ceramic particulate, including albite, illite, and quartz; and a metallic composition, including nickel, chromium, iron, and silicon. The sprayable composition may be a composite particle, a blend, or a cored wire. The abradable coating may be applied to a metal substrate such as steel, nickel-base alloys, and titanium.

US 7267889: K. Hajmrle and A.P. Chilkowich. Company: Sulzer Metco (Canada) Inc. Issued/Filed: September 11, 2007/October 1, 2002.

Pretreatment and Posttreatment

Method of Removing a Coating. A method of removing at least a part of a thermal sprayed wear-resistant coating on a gas turbine engine part includes grinding the thermal sprayed wear-resistant coating with a superabrasive grinding wheel.

US 7264538: P.L. Hood, K.G. Gardiner, B. Keyes, K. Lockyer, E. Marchitto, T.R. Nadeau, D.W. St. Onge, and B.D. Vaillette. Company: United Technologies Corporation. Issued/Filed: September 4, 2007/August 12, 2005.

Surface Conditioning for Thermal Spray Layers. The invention relates to a process of roughening metal surfaces to improve adhesion of layers that are thermally sprayed onto the surface, in which, in the first step, recesses or depressions are introduced into the surface in a material-detaching or material-removing treatment, so that the remaining metal on the surface forms raised microstructures, such as projections, ridges, protuberances, or bumps, with these microstructures being further worked on in at least one further step by shaping and/or breaking so that a significant proportion of the structures forms undercuts in relation to the surface.

WO 27087989: J. Boehm, M. Gruener, M. Hartweg, T. Hercke, K. Holdik, P. Izquierdo, W. Pellkofer, and D. Schilling. Company: DaimlerChrysler AG. Issued/Filed: August 9, 2007/January 19, 2007.

Spraying Systems and Methods

Automatic Stick-Supplying Machine for Stick-Plasma Spraying. CN 2918-445: F.L. Tang. Company: Xi An University of Technology. Issued/Filed: April 7, 2007/June 6, 2006.

Combustion Apparatus for High-Velocity Thermal Spraying. A combustion apparatus is provided that has a precombustion chamber and a combustion chamber. The precombustion chamber houses a preheating combustion apparatus for preheating and at least partially vaporizing fuel supplied to the precombustion chamber. The preheating combustion is controlled so that only a portion of the fuel supplied to the precombustion chamber is burned. The combustion apparatus further includes a primary combustion oxidizer supply located downstream of the apparatus. The primary combustion oxidizer supply supplies an appropriate amount of oxidizer to burn the fuel not burned by the preheating combustion.

US 7261556: V. Belashchenko and A. Voronetski. Issued/Filed: August 28, 2007/May 12, 2004.

Gas-Feeding System for a Detonation Spray Gun. This gas-feeding system for a detonation spray gun has no valves or mechanical sealing devices for feeding the active gases in the combustion, or other inert additive compounds such as nitrogen, argon, helium to name a few. Such feeding of the gases or compounds is performed directly and separately to the detonation chamber through a set of independent passages, one for the oxidant and at least one for the fuel. Each passage consists of an expansion chamber and a number of distribution conduits of small cross section and/or great length. Each passage's expansion chamber is directly connected to the corresponding supply line, while the distribution conduits are conveniently arranged so that several gas injection points open into the inner surface of the combustion chamber, resulting in a continuous and separate feeding of gases at several points that ensures that the fuel mixture is made directly and homogeneously in the combustion chamber and with sufficient flow to fill the chamber in each detonation cycle.

CA 2303014: I.F. Altuna and G.Y. Barykin. Company: Aerostar Coatings, S. L. Issued/Filed: July 10, 2007/September 11, 1997.

Masking Cylinder Bore Extremities from Internal Thermal Spraying. Masking one or more extremities of a cylinder bore from internal thermal spraying, when using a rotary gun inserted from one end of the bore, involves the following steps (i) supporting one or more inflatable mask members adjacent to an end of the bore wall and (ii) pressurizing the inflatable mask member to expand and annularly engage an end of the bore, the mask being constituted of an inflatable and collapsible air tight bag of heat-resistant (fiberglass) cloth coated on opposite sides with a sacrificial heat-resistant nonstick coating (silicone). The inflatable characteristic of the mask member allows it to conform to the periphery of the cylinder bore extremities, and be easily installed in or through the component in its deflated condition. The mask is reusable as it is composed of a coating material that may gradually be sacrificed to heat and wear of the over spray.

CA 2186659: D.A. Donovan. Company: Ford Motor Canada. Issued/Filed: September 25, 2007/Septembe 27, 1996.

Method for Forming a Ceramic Containing Composite Structure. A method for forming a ceramic containing composite structure is proposed comprising the steps of (i) feeding a ceramic component that sublimes and a metallic or semiconductor material that does not sublime into a thermal spray apparatus, (ii) spraying the ceramic component and the metallic or semiconductor material onto a substrate, whereby the ceramic component and the metallic or semiconductor material deposit on the surface of the substrate, and (iii) keeping the metallic or semiconductor material on the substrate surface plastic during spraying at least in the region where the metallic or semi-conductor material actually strikes the surface.

WO 27108793: 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: September 27, 2007/March 20, 2006.

Thermal Barrier Coatings and Bondcoats

Method for Coating a Blade and Blade of a Gas Turbine. A method is provided for coating a hollow, internally cooled blade of a gas turbine, in which an outer coating comprising an MCrAlY-based bonding layer and a ceramic thermal barrier layer of zirconium oxide is applied to the base material of the blade on the outer side and an inner coating comprising a Cr diffusion layer is applied to the base material of the blade on the inner side. The MCrAlY-based bonding layer is then applied to the finished blade. At the same time, along with the inner coating, the Cr diffusion layer is also applied to the MCrAlY-based bonding layer of the outer coating by chemical vapor deposition. Subsequently, an Al diffusion layer and an outer brittle Al buildup layer are applied by chemical vapor deposition to the bonding layer coated with the Cr diffusion layer. After that, the outer brittle Al buildup layer is removed by an abrasive treatment, and the ceramic thermal barrier layer is applied to the Al diffusion layer.

WO 27101465: S. Chandra and N. Czech. Company: MAN Turbo AG. Issued/Filed: September 13, 2007/December 12, 2006.

Process for a Beta-Phase Nickel Aluminide Overlay Coating. This is a process for forming a beta-phase nickel aluminide (NiAl) overlay coating that is suitable for use as a bond coat for a thermal barrier coating (TBC). The overlay coating is deposited by a method that produces a generally columnar grain structure in which grains extend through the coating such that at least some grain boundaries are open at the coating surface. The coating is then peened with a particulate media, followed by heating the overlay coating to a temperature sufficient to cause the overlay coating to recrystallize and form new grain boundaries that are not open to the outer surface of the coating and significantly less susceptible to accelerated oxidation than the original grain boundaries. The particulate media is made of a composition containing nickel and aluminum, such that an oxide scale that forms on the surface of the coating after the peening operation is substantially free of deleterious oxide compounds, notably iron-containing spinels.

US 7244467: T.R. Grossman, R. Darolia, and J.D. Rigney. Company: General Electric Co. Issued/Filed: July 17, 2007/July 15, 2003.

Thermal Barrier Coating and a Method of Applying Such a Coating. The method and arrangement for providing a ceramic thermal barrier coating (TBC), deposited and attached directly to a metallic substrate, or an intermediate bond coating deposited on such a substrate is presented. The TBC includes at least two layers, where in the first, the inner TBC layer, that is directly attached to the substrate or bond coating, presents a different microstructure than the second, outer TBC layer.

US 7258934: J. Wigren and M.-O. Hansson. Company: Volvo Aero Corp. Issued/Filed: August 21, 2007/September 25, 2003.

Thermal Barrier Coating System Utilizing Localized Bond Coat and Article Having the Same. A thermal barrier coating system for a superalloy substrate is disclosed. The superalloy is preferably of the type that is capable of forming an adherent alumina layer. A bond coat is applied to a local area of the substrate so that a portion of the substrate remains exposed. The localized area is defined to be the area(s) at which a TBC typically fails first, e.g., the leading and trailing edges of an airfoil or other area. An alumina layer is formed on the remaining portion of the substrate and also on the bond coat. A ceramic layer is then applied on the alumina layer. Even if the ceramic material is removed, the localized bond coat remains and reduces the rate at which the underlying substrate oxidizes. A coated article is also disclosed, as is a system that uses a conventional superalloy and aluminide coating with the localized bond coat.

CA 2274412: S. Bose, D.K. Gupta, J.T. Marcin, and N.E. Ulion. Company: United Technologies Corp. Issued/Filed: September 4, 2007/June 11, 1999.