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Selected Patents Related to Thermal Spraying

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EP denotes European 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

Electrical contact connection and method for creating one such contact connection. The aim of the invention is to enable a reliable and long-lasting connection between an electrical conductor consisting of a soft material, especially an aluminum conductor, and a contact element consisting of a harder material. To this end, the conductor is at least partially extrusion-coated in a contact region by means of a thermal spray method, with an electroconductive material that is harder than the soft material of the conductor, in such a way that a pressure-free electrical connection is created between the soft material and the sprayed material. The contact element is electrically contacted indirectly over the sprayed material. The thermal extrusion-coating in the contact region enables a reliable electrical contact even with soft materials having a cold flow tendency.

WO 6000279: G. Reichinger. Company: Leoni AG. Issued/Filed: Jan 5, 2006/May 25, 2005.

Gas sensor and method for manufacturing same. Disclosed is a gas sensor for sensing a volatile organic compound that comprises a substrate and a gas-sensing part that is arranged on the substrate and mainly composed of a metal oxide. The gas sensor is characterized in that the metal oxide is thermally sprayed onto the substrate by high-frequency induction plasma thermal spraying and then subjected to a thermal treatment. Also disclosed is a method for manufacturing a gas sensor for sensing a volatile organic compound that is characterized by comprising a step for thermally spraying a metal oxide on a substrate by high-frequency induction plasma thermal spraying and a step for thermally processing the thus-sprayed metal oxide.

WO 6006493: T. Katsube, M. Nakano, T. Kaneko, and K. Nakamura. Company: Uchiya Thermostat Co., Ltd. Issued/Filed: Jan 19, 2006/July 7, 2005.

Method for the production of thin dense ceramic layers. The invention relates to a method for the production of a thin dense ceramic layer on a substrate by means of atmospheric plasma spraying, whereby the following steps are carried out: 1) the substrate is preheated to a temperature corresponding to at least a quarter of the melting point of the ceramic for application in Kelvin, 2) a ceramic powder or a ceramic powder mixture with d_{50}-values of less than 50 μm is used as spray adjunct, 3) particle speeds at incidence on the substrate of more than 200 m/s are set, 4) particle temperatures are set such that on incidence on the substrate surface the particles have a temperature at least 5% above the melting point of the ceramic for application in Kelvin, 5) the amount of the spray adjunct and passage speed of the plasma burner are set such that on a single pass of the substrate a layer thickness of less than 100 μm is achieved, 6) a thin and also gas-tight layer is generated on the substrate with a single pass of the substrate, which has a leakage rate of less than 10^{-1} mbar L/(cm^2 s).

WO 6029587: R. Vassen, D. Hathiramani, and D. Stoever. Company: Forschungszentrum Juelich GmbH. Issued/Filed: March 23, 2006/Aug 4, 2005.

Plasma sprayed ceria-containing interlayer. A plasma sprayed ceria-containing interlayer is provided. The interlayer has particular application in connection with a solid-oxide fuel cell used within a power-generation system. The fuel cell advantageously comprises an air electrode, a plasma sprayed interlayer disposed on at least a portion of the air electrode, a plasma sprayed electrolyte disposed on at least a portion of the interlayer, and a fuel electrode applied on at least a portion of the electrolyte.

US 6984467: D.S. Schmidt and G.R. Folser. Company: Siemens Westinghouse Power Corp. Issued/Filed: Jan 10, 2006/Sept 24, 2002.

Substrates with small particle size metal oxide and noble metal catalyst coatings and thermal spraying methods for producing the same. A substrate having a catalytic surface thereon characterized as a coating of metal oxide and noble metal particles in the nominal diameter size distribution range of <3 μm, and more particularly <1 μm, is produced by thermal spraying a mixture of large size particles (e.g., in a nominal size distribution range of >10 μm) of hydroxides, carbonates, or nitrates of the metals: Ce, Al, Sn, Mn, Cu, Co, Ni, Pr, or Tb particles; and hydroxides, carbonates or nitrates of the noble metals: Ru, Rh, Pd, Ag, Ir, Pt, and Au onto the substrate. The coating adheres to the surface and provides desirable catalyst properties.

US 7005404: T. He. Company: Honda Motor Co., Ltd. Issued/Filed: Feb 28, 2006/July 24, 2001.

System and method for fabricating or repairing a part. According to one embodiment of the invention, a system for fabricating a part includes a computer operable to control the fabrication of a three-dimensional part using a solid CAD model, a deposition station operable to deposit successive two-dimensional layers of material to fabricate the three-dimensional part, and a machining station operable to remove at least a portion of one or more of the deposited two-dimensional layers of material. The deposition station includes a substrate on which to fabricate the three-dimensional part, a welding-based deposition system having a welding torch, a laser-based deposition system having a laser head, a plasma powder cladding system having a plasma torch, and a multiaxis robot operable to, when directed by the computer, utilize one of the welding-based deposition system, laser-based deposition system, and plasma powder cladding system to deposit any of the two-dimensional layers of material. The machining station includes a multiaxis milling machine and an automatic tool changer. The milling machine is operable to, when directed by the computer, select from a plurality of machining tools associated with the automatic tool changer for use in the milling machine.

US 7020539: R. Kovacevic and M.E. Valant. Company: Southern Methodist University. Issued/Filed: March 28, 2006/Aug 25, 2003.

Thermal spray application of brazing material for manufacture of heat transfer devices. The invention relates to a method of manufacturing and coating heat transfer parts for a heat exchanger such as tubes in an automobile radiator. The tubes are coated with brazing material by thermal spraying, such as plasma deposition or wire-arc deposition. The coating is then melted by application of heat to braze the tubes to the fins and to the headers to complete the formation of the heat exchanger.

US 6997371: Y.L. Shabtay. Company: Outokumpu Oyj. Issued/Filed: Feb 14, 2006/April 26, 2005.

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: March 2, 2006/Aug 22, 2005.

Feedstock

Process for making nanosized stabilized zirconia. A process to produce stabilized zirconia from a solution of zirconium salt and a stabilizing agent. The zirconium salt may include zirconium oxysulfate, zirconium oxychloride, zirconium oxynitrate, zirconium nitrate, and other water-soluble zirconium salts. The stabilizing agent may include calcium, magnesium, yttrium salts of oxides, and rare earth oxides. The process is conducted by evaporation of the solution above the boiling point of the solution but below the temperature where there is significant crystal growth. The evaporation step is followed by calcination to produce the desired nanosized structure. Further processing by sintering may be applied to produce solid structures or by milling and classification to produce material for thermal spray coating.

US 6982073: B.J. Sabacky and T.M. Spitler. Company: Altair Nanomaterials Inc. Issued/Filed: 2006-01-03/2001-11-02.

Spray powder for hardfacing and part with hardfacing. A spray powder for thermal spraying onto a substrate to provide a hardfacing, and a part with such hardfacing on the surface thereof, that is corrosion-resistant and abrasion-resistant. The spray powder comprises between about 75 to about 90 wt.% of tungsten carbide. The powder further comprises between about 10 and 25 wt.% of a nickel-base alloy, which includes Mo, and optionally, includes one or more of Fe, C, Cr, Mn, Co, Si, and W.

EP 682577: C.J. Terry. Company: Kennametal Inc. Issued/Filed: Jan 4, 2006/Jan 27, 1994.

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 to 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 Ni, Co, Cu, Fe, and Al 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 7008462: P. Fiala, A.P. Chilkowich, and K. Hajmrle. Company: Sulzer Metco (Canada) Inc. Issued/Filed: March 7, 2006/Dec 16, 2004.

Thermal spraying powder and method of forming a thermal sprayed coating using the same. The present invention relates to a thermal spraying powder capable of reliably allowing the achievement of a thermal sprayed coating having superior characteristics. A thermal spraying powder according to a first embodiment of the invention includes a predetermined amount of each of molybdenum, B, Co, and Cr. The total content of Mo, B, C, and Cr in the thermal spraying powder is no less than 95 wt.%. The primary crystal phase of the thermal spraying powder is multielement ceramics containing at least one of Co and Cr along with Mo and B. A thermal spraying powder according to a second embodiment of the invention includes a predetermined amount of each of Mo, B, Ni, and Cr. The total content of Mo, B, Ni, and Cr in this thermal spraying powder is no less than 95 wt.%. The primary crystal phase of this thermal spraying powder is multielement ceramics containing at least one of nickel and chromium along with Mo and B.

US 6984255: T. Itsukaichi and S. Osawa. Company: Fujimi Inc. Issued/Filed: Jan 10, 2006/March 26, 2004.

Spraying Systems and Methods

An apparatus and process for solid-state deposition and consolidation of high-velocity powder particles using thermal plastic deformation. Particulate deposition device for accelerating powder particles onto substrate, has diverging tapered outlet of gas channel, which maintains the gas at constant velocity equal to secondary velocity of gas passing through inlet.

EP 1383610: H. Gabel and R. Tapphorn. Company: Innovative Technology, Inc. Issued/Filed: March 29, 2006/April 20, 2002.

High-velocity thermal spray apparatus. A thermal spray apparatus is provided for thermal spraying a coating onto a substrate. The apparatus includes a heating module for providing a stream of heated gas. The heating module is coupled to a forming module for controlling pressure and velocity characteristics of the stream of heated gas generated by the heating module. The thermal spray apparatus further includes a barrel capable of directing the stream of heated gas from the forming module. A powder injection module may be provided for introducing powder material into the stream of heated gas.

WO 6002258: V. Belaschchenko and A. Voronetski. Issued/Filed: Jan 5, 2006/June 21, 2005.

Method and apparatus for thermal spray coating. A method of supplying a coating to a substrate by spraying heated particles of a coating material onto the substrate. The particles are heated to a temperature and sprayed at a velocity such that the total energy of the particles is less than the energy necessary to melt the particles. When the particles collide with the substrate, the particles may plastically deform to a diameter with the substrate that is greater than the diameter of the particle prior to colliding with the substrate. The deformed particle may bond to the substrate about the majority of the deformed diameter of the particle.

WO 6023450: V. Belaschchenko. Issued/Filed: March 2, 2006/Aug 15, 2005.

Method of making thermally sprayed articles. A thermally sprayed article and method of making same includes the steps of providing an article to be thermally sprayed and thermally spraying a metal material against the article to form an inner layer having a first predetermined thickness. The method also includes the steps of co-depositing a polymer and the metal material against the inner layer to form an outer layer having a second predetermined thickness.

EP 1063315: O.O. Popoola and R.P. Cooper. Company: Ford Global Technologies, LLC. Issued/Filed: Feb 15, 2006/June 19, 2000.

A thermal spraying device. Thermal sprayer used in aerospace constructions, has frame element projecting in flame injection direction from end piece and partly surrounding flame zone extending from end piece.

EP 1552728: P. Nylen, A. Boussagol, R. Svensson, G. Mora, M.-O. Hansson, J. Wigren, and J. Johansson. Company: Volvo Aero Corp. Issued/Filed: March 22, 2006/Sept 17, 2003.

Thermal Barrier Coatings and Bondcoats

Low conductivity and sintering-resistant thermal barrier coatings. A thermal barrier coating composition is provided. The composition has a base oxide, a primary stabilizer, and at least two additional cationic oxide dopants. Preferably, a pair of group A and group B defect cluster-promoting oxides is used in conjunction with the base and primary stabilizer oxides. The new thermal barrier coating is found to have significantly lower thermal conductivity and better sintering resistance. In preferred embodiments, the base oxide is selected from zirconia and hafnia. The group A and group B cluster-promoting oxide dopants preferably are selected such that the group A dopant has a smaller cationic radius than the primary stabilizer oxide, and so that the primary stabilizer oxide has a small cationic radius than that of the group B dopant.

US 7001859: D. Zhu and R.A. Miller. Company: Ohio Aerospace Institute, The United States of America as represented by the Administrator of the National Aeronautics and Space Administration. Issued/Filed: Feb 21, 2006/Aug 27, 2004.

Method for manufacturing articles for high-temperature use, and articles made therewith. A method for manufacturing an article for use in a high-temperature environment, and an article for use in such an environment, are presented. The method comprises providing a substrate; selecting a desired vertical crack density for a protective coating to be deposited on the substrate; providing a powder, wherein the powder has a size range selected to provide a coating having the desired vertical crack density; and applying a thermal sprayed coating to the substrate, the coating having the desired vertical crack density, wherein the powder is used as a raw material for the coating.

US 7005200: H. Wang, D.J. Mitchell, Y.C. Lau, and A.T. Henry. Company:General Electric Co. Issued/Filed: Feb 28, 2006/Jan 14, 2005.

Smooth outer coating for combustor components and coating method therefor. A coating and method for reducing the incidence of cracking in a combustor assembly of a gas turbine engine, and particularly combustor assemblies of at least two components that are welded together to define a weld region that is prone to cracking at combustion temperatures sustained within the combustion chamber of the gas turbine engine. At least the surface of the weld region protected by a coating system comprising a thermal sprayed metallic bond coat and a ceramic coating deposited on the bond coat. The ceramic coating is deposited by thermal spraying a powder having a particle size of not greater than 10 μm and the outer surface of the coating system is smoother than the outer surface of the bond coat on which the ceramic coating is deposited.

WO 6006995: B.K. Gupta, E.J. Emilianowicz, and M. Muneeruddin. Company: General Electric Co. Issued/Filed: Jan 19, 2006/April 15, 2005.

Thermal barrier coating protected by alumina 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 optional inner layer nearest to the underlying metal substrate comprising a non-alumina ceramic thermal barrier coating material in an amount up to 100% and an outer layer having an exposed surface and comprising at least about 50% of a non-alumina ceramic thermal barrier coating material and alumina in an amount up to about 50% and sufficient to protect the thermal barrier coating at least partially against environmental contaminants that become deposited on the exposed surface. 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 optionally forming the inner layer of the non-alumina ceramic thermal barrier coating material, and then codepositing the alumina and non-alumina ceramic thermal barrier coating material to form the outer layer.

US 7008674: B.A. Nagaraj, B.A. Boutwell, and R.G. Baur. Company: General Electric Co. Issued/Filed: March 7, 2006/Nov 18, 2004.

Thermal insulating material and method of producing same. A thermochemically stable oxidic thermal insulating material presenting phase stability, which can be used advantageously as a thermal insulating layer on parts subjected to high thermal stress, such as turbine blades or such like. The thermal insulating material can be processed by plasma spraying and consists preferably of a magnetoplumbite phase whose preferred composition is $MMeAl_{11}O_{19}$, where M is La or Nd and where Me is chosen from among zinc, the alkaline earth metals, transition metals, and rare earths, preferably from magnesium, zinc, cobalt, manganese, iron, nickel, and chromium.

US 6998064: R. Gadow and G. Schaefer. Company: MTU Aero Engines GmbH. Issued/Filed: Feb 14, 2006/July 14, 2003.