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Selected Patents Related to Thermal Spraying

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Prepared by Jiří Matějíček, Institute of Plasma Physics, Za Slovankou 3, 18,200 Praha 8, Czech Republic, tel: +420-266 053 307; e-mail: jmatejic@ipp.cas.cz. Adapted with permission from Delphion, http://www.delphion.com/

EP denotes European patent, RO denotes Romanian patent, SG denotes Singaporean 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

Calcium Phosphate Bone Graft Material, Process for Making Same and Osteoimplant Fabricated from Same. A calcium phosphate bone graft material comprising an amorphous calcium phosphate glassy phase of from about 30 to about 100 vol.% is obtained by plasma spraying calcium phosphate-containing powder onto a target to produce a deposited layer and removing the deposited layer from the target to provide the calcium phosphate bone graft material.

US 6,846,853. L.A. Shimp. Company: Osteotech, Inc. Issued/Filed: Jan 25, 2005/July 16, 2002.

Coated Vehicle Wheel and Method. A method of coating a vehicle wheel to increase wear and corrosion resistance of the vehicle wheel, includes the steps of providing a vehicle wheel and applying a wear- and corrosion-resistant coating onto a surface of the vehicle wheel. The coating is applied to at least a tire bead retaining flange of the vehicle wheel. The coating is of particular use with vehicle wheels made of forged aluminum. The coating is selected from tungsten carbide, optionally including cobalt or chrome, a nickel-base superalloy, aluminum and silicon carbide, or stainless steel. The coating is typically applied to a thickness of about 0.004-0.01 in.. The surface of the vehicle wheel may be prepared by mechanically abrading the surface or chemically etching the surface of the vehicle wheel. The coating may be applied by cold spraying, thermal spraying, or triboelectric discharge kinetic spraying and other similar processes.

US 6,872,425. R.W. Kaufold, N.C. Whittle, E.P. Patrick, and A.V. Pajerski. Company: Alcoa Inc. Issued/Filed: March 29, 2005/Sept 25, 2003.

Component Carrier. The present invention relates to a component carrier that includes a frame and a sealing lip. The frame includes walls defining an internal opening. The frame may be made of metal and the sealing lip of thermoplastic elastomer. The sealing lip is a single piece that is applied to the frame by injection molding or spraying. The frame may further include recesses or openings along the walls defining its cavity. The cooling thermoplastic elastomer may then grip or adhere to the walls so as to retain its shape. The current invention provides increased compensation tolerances for components accommodated therein.

WO 5,015,969. H. Kirner and T. Wahler. Company: Siemens AG. Issued/Filed: Feb 17, 2005/June 9, 2004.

Cooking Utensils with Thermally Sprayed Coating and Method for the Production of Said Coating. A cooking utensil with a thermally sprayed coating and a method for coating a cooking utensil by thermal spraying, high-speed flame spraying, and plasma spraying are provided. The plastic spray particles, which provide nonsticking properties but char at high temperatures, and the oxide particles, which require heat and provide high scratch resistance, are applied separately at a distance from one another. The plastic particles are fed from a powder tube, which is placed closer to the work piece than the oxide particle supply site.

EP 1,387,896. P. Heinrich and W. Kroemmer. Company: Linde AG. Issued/Filed: Jan 5, 2005/May 2, 2002.

Metallic Sliding Member, Piston for Internal Combustion Engine, Method of Surface Treating These, and Apparatus Therefor. A metallic sliding member that is improved in initial compatibility and significantly reduced in frictional resistance, and a process for producing the member. The process comprises causing fine particles of molybdenum disulfide to collide against the surface of a base to form a layer containing molybdenum disulfide, serving as a solid lubricant, as a surface layer having a depth not larger than 20 μm from the surface.

US 6,863,922. H. Ogihara and M. Ishiwata. Company: Honda Giken Kogyo Kabushiki Kaisha. Issued/Filed: March 8, 2005/Nov 16, 2001.

Method and Device for Producing a Ceramic Composite Body. The invention relates to a method and a device for producing a ceramic composite body. Said method is carried out in several steps: a reinforcement component is first provided; a quantity of a preceramic polymer is then sprayed onto the reinforcement component; and said quantity of sprayed polymer is converted into a ceramic by means of a thermal treatment, in such a way that the ceramic composite body is formed by a layered application.

WO 5,003,059. E. Feike, O. Goerke, and H. Schubert. Company: Technische Universitaet Berlin. Issued/Filed: Jan 13, 2005/July 1, 2004.

Method of Manufacturing an Electrolytic Cell. A method of manufacturing an electrolytic cell in which an intermediate sintered form is produced that comprises a porous anode layer and an electrolyte layer having a prespecified shape of the electrolytic cell. The electrolyte layer has defects extending through the electrolyte layer. A substance by way of a pressure, a solvent, particle suspended in a solvent, or particles introduced by way of thermal spray are introduced into defects within the electrolyte layer. Thereafter, a green cathode layer is applied to the electrolyte layer, while the substance is in place, within the defects. The intermediate sintered form with the applied green cathode layer is then fired to produce the electrolytic cell.

US 6,858,045. H. Chen and W. Wang. Company: Praxair Technology, Inc. Issued/Filed: Feb 22, 2005/Nov 29, 2002.

Particle Accelerator Cavity with Reinforced Supraconductive Material, and Method for Making Same. The invention concerns a method for making a rigidized structure comprising at least an element with supraconductive properties, and rigidizing means, said method comprising a step consisting in depositing by plasma spraying a layer of material on the surface of said element.

EP 1,020,101. J. Marini. Company: Center National de la Recherche Scientifique. Issued/Filed: March 16, 2005/Sept 28, 1998.

Production Method for a Regenerative Heat Exchange Circuit for High Thermal Flow, Especially for Rocket Combustion Chambers. Producing regenerative circuit structure for intense thermal flows, in particular, for combustion chamber of rocket motor. The method includes a number of steps. The first step involves production of an intermediate layer on a support mandrel representing the interior profile of the structure. The second step involves production of a series of channels uniformly distributed around the mandrel for soluble inserts. The third step involves preheating of the mandrel and production of the body of the structure by a thermal deposition process under vacuum. The fourth step involves machining of the channels in the body and introduction of soluble inserts. The fifth step involves production of a closing layer and an outer envelope by a thermal deposition process under vacuum, after preheating. The sixth step involves removal of the soluble inserts and the intermediate layer.

EP 943,795. D. Cornu, C. Verdy, J.-M. De Monicault, and C. Coddet. Company: S.N.E.C.M.A. Issued/Filed: Jan 12, 2005/March 19, 1999.

Thermal Spray Deposited Electrode Component and Method of Manufacture. An electrode component for an electrochemical cell is described wherein the electrode is produced by thermal spraying an electrode active material onto a substrate to coat the substrate. Suitable thermal spraying processes include chemical combustion spraying and electrical heating spraying, using both wire and power processes.

EP 830,464. B.C. Muffoletto, W.M. Paulot, and J.E. Spaulding. Company: Wilson Greatbatch Ltd. Issued/Filed: Jan 5, 2005/Oct 30, 1996.

Thermal Sprayed Tooling. A metallic shell used, for example as a mold, is formed by spray deposition connected to a 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 conductivity in various regions.

US 6,871,830. C.P. Covino. Company: GMIC, Corp. Issued/Filed: March 29, 2005/June 11, 2002.

Thermal Spray Method for Adhering a Catalytic Material to a Metallic Substrate. A method for applying a coating of catalytic material onto a metallic substrate involves thermal spray deposition of refractory oxide particles directly onto the substrate, preferably to attain an undercoat having a surface roughness of R_a 3 or greater. The catalytic material may then be applied to the undercoated substrate in any convenient manner. In a particular embodiment, the metallic substrate is treated by grit blasting prior to the application of an undercoat principally containing alumina. The coated substrate can be used in the assembly of a catalyst member for the treatment of exhaust gases.

EP 804,290. S. Sung, M.P. Galligan, and P.L. Burk. Company: Engelhard Corp. Issued/Filed: March 23, 2005/Jan 17, 1996.

Valve Seat Rings Made of Basic Co or Co/Mo Alloys, and Production Thereof. Disclosed is a cylinder head for internal combustion engines, comprising a metallic valve seat ring that is formed by a thermally sprayed homogeneous layer made of a basic cobalt or cobalt/molybdenum alloy. The sum of the cobalt content and molybdenum content in the alloy exceeds 50 wt.% while the iron content lies below 5 wt.%. Also disclosed is a method for thermally spraying said valve seat ring by means of an arc wire spraying process with the aid of at least two filler wires and/or composite wires, the essential cobalt portion in the deposited layer being delivered by the jacket of the filler wire and/or the matrix of the composite wire.

WO 5,012,590. E. Esswein, S. Grau, T. Haug, and A. Sagel. Company: Daimler-Chrysler AG. Issued/Filed: Feb 10, 2005/July 21, 2004.

Characterization

Process and Device for Determining the Layer Thickness, the Conductivity, and/or the Layer Contact Quality of Layers Deposited on Substrates. The invention relates to a process for determining the layer thickness(es), the heat conductivity(ies), and/or the layer contact quality of layers or layer systems deposited on substrates using photothermal means, in which light is directed on the layer to be measured and the time-dependent temperature rise, temperature drop, and/or the maximum amplitude is measured photothermally by a detector.

EP 803,062. H.H. Schulz and P. Kohns. Company: OptiSense GmbH & Co. Issued/Filed: Jan 26, 2005/Jan 11, 1996.

Feedstock

Method for Obtaining Nanoparticles. The method is intended for obtaining nanosize amorphous particles, which find use in various fields of science and technology; in particular, metallic nanostructures can be regarded as a promising material for creating new sensors and electronic and optoelectronic devices and for developing new types of highly selective solid catalysts. The method for obtaining nanoparticles includes the following stages: dispersion of a molten material; supply of the resulting liquid drops of this material into a plasma with parameters satisfying the aforementioned relationships, which is formed in an inert gas at a pressure of 10^{-4} to 10^{-1} Pa; cooling of liquid nanoparticles formed in the said plasma to their hardening; and deposition of the resulting solid nanoparticles onto a support.

WO 5,023,460. S.A. Gurevich, V.M. Kozhevin, and D.A. Yavsin. Issued/Filed: March 17, 2005/Aug 10, 2004.

Method of Producing a Prealloyed Stabilized Zirconia Powder. A prealloyed stabilized zirconia powder suitable for use in thermal barrier applications is formed by alloying zirconia with a stabilizer, such as yttria, and processing the alloyed stabilized zirconia to form a very fine powder. The raw powder is then spray dried to produce an agglomerated powder having an average particle size suitable for use in spray coating applications. The resulting powder can be used in a thermal spray application to produce a porous thermal barrier coating having a substantially decreased thermal conductivity when compared with conventional TB coatings, such those produced using plasma-densified powders.

US 6,869,550. M.R. Dorfman, L.F. Correa, C.G. Dambra, K. Laul, and R.K. Schmid. Company: Sulzer Metco (US) Inc. Issued/Filed: March 22, 2005/Dec 7, 2001.

Rare-Earth Oxide Thermal Spray Coated Articles and Powders for Thermal Spraying. A rare-earth oxide thermal spray coated article comprising a substrate and a coating layer formed by thermally spraying a rare-earth oxide thermal spraying powder onto a surface of the substrate, said coating layer being of a gray or black color having, in the L*a*b* color space, an L* value of up to 50, an a* value of –3.0 to +3.0, and a b* value of –3.0 to +3.0.

US 6,852,433. T. Maeda. Company: Shin-Etsu Chemical Co., Ltd. Issued/Filed: Feb 8, 2005/July 15, 2003.

Wear-Resistant, Corrosion-Resistant Ni-Cr-Mo Thermal Spray Powder and Method. Enhancing wear and corrosion resistance of an industrial component by depositing a nickel-base alloy coating having a thickness of at least about 50 μm onto a surface of the industrial component by high-velocity oxyfuel propulsion of a nickel-base alloy powder containing (a) chromium, (b) from about 15 to about 25 wt.% Mo, (c) no more than about 1 wt.% Fe, and (d) no more than about 1 wt.% elements having an atomic number greater than 42. A nickel-base alloy powder for HVOF deposition containing (a) chromium, (b) from about 15 to about 25 wt.% Mo, (c) no more than about 1 wt.% Fe, and (d) no more than about 1 wt.% elements having an atomic number greater than 42. A nickel-base coating on an industrial component having enhanced corrosion and wear resistance.

US 6,863,990. J.B.C. Wu and M.X. Yao. Company: Deloro Stellite Holdings Corporation. Issued/Filed: March 8, 2005/May 2, 2003.

Spraying Systems and Methods

Apparatus and Method for Thermal Spraying. The invention relates to an apparatus and a method for producing a sprayed layer on the surface of a substrate, wherein an admixture material that may have started to melt or is molten, is guided onto the surface of the substrate to be coated using a gas or gas mixture, as well as a relevant installation for producing the sprayed layer by means of a thermal spraying method, wherein the installation comprises means for supplying the admixture material or the gas or gas mixture. According to the invention, at least one feature of the thermal spraying process that influences the quality of the sprayed layer and that is responsible for the formation of the layer and its properties, is recorded, evaluated and assessed, checked, monitored, and/or regulated. Both analog and digital spectroscopic arrangements can be used as optical emission spectroscopic arrangements. The recording, evaluation and assessment, checking, and/or monitoring using the optical emission spectroscopic arrangement can advantageously be used for online regulation and, if necessary, also for optimizing one or a plurality of parameters responsible for the formation of the layer and its properties.

US 6,841,005. K. Schutte. Company: Flumesys GmbH Fluidmess-und Systemtechnik. Issued/Filed: Jan 11, 2005/Jan 31, 2003.

Arc Thermal Spray Gun and Gas Cap Therefor. An arc spray gun has a pair of tubular wire guides that guide two metal wires to a point of contact at the wire tips where an arc current through the wires effect an arc, thereby melting the tips. Primary gas channeling on a central axis issues a primary gas flow that atomizes the molten metal and effects a spray stream thereof. A gas cap has at least four orifices accurately spaced equally about the central axis. The orifices direct secondary gas jets inwardly with a forward directional component toward a point of intersection of the orifice axes on the central axis. The point of intersection is located proximate the point of contact and spaced downstream therefrom sufficiently for the jets not to interfere substantially with the atomization. The spray stream thereby is constricted and accelerated by the secondary gas jets.

EP 938,932. R. Benary, R. Boehm, and L. Dirmeier. Company: Sulzer Metco (US) Inc. Issued/Filed: Jan 26, 2005/Feb 4, 1999.

Coatings, Materials, Articles, and Methods of Making Thereof. A thermal spray process comprises injecting precursor solution droplets into the hot zone of the thermal spray flame wherein a first portion of the precursor solution droplets is injected into a hot zone of the flame and a second portion of the precursor solution droplets is injected into a cool zone of the flame. Also described are materials and coatings resulting from the process.

WO 5,017,226. M. Gell, E.H. Jordan, N.P. Padture, L. Xie, X. Ma, D. Xiao, and A. Decarmine. Company: University of Connecticut, Inframat Corp., US Nanocorp., Inc. Issued/Filed: Feb 24, 2005/Jan 12, 2004.

High-Efficiency Nozzle for Thermal Spray of High-Quality, Low-Oxide-Content Coatings. The present invention provides a spray gun with associated nozzle attachments for high deposition efficiency for thermal spray of high quality, dense, low-oxide-content coatings. The spray guns are used to produce coatings using a thermal spray process, a high-velocity oxyfuel process, a high-velocity air-fuel process, cold spraying, and plasma spraying in which the process is characterized by having an overexpanded flow with a Mach number from about 1.0 to about 4.0 which have passageway section that diverges to the gun outlet. In one embodiment the nozzle attachment is another diverging section with a greater angle of divergence than the diverging nozzle section. In another embodiment the nozzle attachment includes the aforementioned diverging nozzle attachment section followed by a converging nozzle section having an outlet section through which the thermal spray is emitted.

US 6,845,929. A. Dolatabadi, J. Mostaghimi, and V. Pershin. Issued/Filed: Jan 25, 2005/March 22, 2002.

Method of Shielding Effluents in Spray Devices. This invention provides a unique gas shield or shroud surrounding the effluent of a thermal spray device that effectively can extend the working distance or standoff between the thermal spray device and the surface being coated. This invention provides a method of spraying materials, including ceramic materials and reactive materials, at a long standoff and a method of controlling the temperature of the effluent being deposited using heated gas shield.

WO 5,012,588. T.A. Taylor and J.E. Jackson. Company: Praxair S.T., Inc. Issued/Filed: Feb 10, 2005/July 29, 2004.

Method of Thermal Spraying Metal. Method for thermal spraying a metal stream onto a low heat-resistant substrate using an adhesive/release promoted interface with the metal stream and the articles so produced for use in various applications.

WO 5,012,589. G. Grinberg and M.M. Shade. Company: Praxair S. T., Inc. Issued/Filed: Feb 10, 2005/July 30, 2004.

Plasma Jet Spray Generator. The invention relates to a plasma jet spray generator meant for making special coatings by plasma jet thermal spraying. According to the invention, the generator consists of a rear body supporting a nut-cathode assembly with a simple construction and an effective cooling, a screw plug for directing the cooling water, an insulating body ensuring the continuity of the water circuit and the access/distribution of the plasma gas, a support for the cathode assembly that also ensures the intake of the cooling water and a front body for the plasma nozzle, ensuring the outlet circuit.

RO 119,673. N. Markocsan and R. Molnar. Company: Institutul de sudura si in-

cercari de materiale. Issued/Filed: Jan 28, 2005/Nov 27, 1998.

Plasma Spraying Method, and Device That Is Suitable Therefor. The invention relates to a method for coating a substrate with a powder by means of a thermal spraying process, in which the powder is introduced into a plasma jet and is applied to the substrate with the aid of the plasma. According to the invention, at least some of the powder that diverges from the plasma jet is deflected from the substrate and/or redirected into the plasma jet by a means. A device that is suitable for carrying out the inventive method and deflects and/or focuses a portion of a powder jet comprises a means for deflecting and/or focusing particles, which has the shape of a hollow cylinder and contains graphite and/or high-grade steel. Said means has a minimum inner diameter ranging between 5 and 30 mm, particularly between 10 and 20 mm, and a length of 5-80 mm, especially 10-50 mm. The inner and/or outer surface of the means is provided with a surface geometry that is curved in such a way that said means is able to deflect and/or focus powder particles diverging from an introduced powder jet.

WO 5,007,921. J.-E. Doering, R. Siegert, R. Vassen, and D. Stoever. Company: Forschungszentrum Juelich. Issued/Filed: Jan 27, 2005/June 11, 2004.

Plasma Spray Method for Applying a Coating Utilizing Particle Kinetics. A method of operation of a plasma torch. A cold high-pressure carrier gas containing a powder material is injected into a cold main high pressure gas flow and then this combined flow is directed coaxially around a plasma exiting from an operating plasma generator and converging into the hot plasma effluent, mixing with the effluent to form a gas stream with a net temperature, based on the enthalpy of the plasma stream and the temperature and volume of the cold high-pressure converging gas, such that the powdered material will not melt. The combined flow with entrained is directed through a supersonic nozzle accelerating the flow to supersonic velocities sufficient that the particles striking the workpiece achieve kinetic energy transformation into elastic deformation of the particles as they impact the workpiece forming a cohesive coating.

US 6,861,101. K.A. Kowalsky and D.R. Marantz. Company: Flame Spray Industries, Inc. Issued/Filed: March 1, 2005/Dec 19, 2002.

Self-Supporting Three-Dimensional Components Deposited by Means of a Thermal Spraying Method. The invention relates to self-supporting three-dimensional components consisting of a metal/metal composite material (IMC), or a metal/ceramic composite material (cermet) that are produced by means of thermal deposition, the metallic or ceramic dispersed phase being more than 25 vol.%. The invention also relates to methods for producing said components by means of electric arc wire spraying, especially using lost substrates, at least one filler wire being used in the electric arc wire spraying method at least for the cermet components.

WO 5,014,208. S. Grau, T. Haug, and A. Sagel. Company: DaimlerChrysler AG. Issued/Filed: Feb 17, 2005/July 7, 2004.

Thermal Spray Application of Polymeric Material. A polyether etherketone (PEEK) composite may be applied to a metallic substrate through a high-velocity oxyfuel (HVOF) process. The metallic substrate is prepared with a metallic bonding layer that is arc sprayed onto its surface. A powderized PEEK composite material is then heated and propelled against the substrate and bonding layer by an HVOF technique to uniformly coat the substrate. Following the HVOF process, the PEEK coating is annealed to provide a durable, PEEK-coated substrate.

SG 108,212. T.H.F. Tan, M.L. Taylor, and B.H. Tan. Company: Camco Intl. Inc. Issued/Filed: Jan 28, 2005/Sept 21, 1999.

Thermal Barrier Coatings and Bondcoats

Blanch Resistant and Thermal Barrier NiAl Coating Systems for Advanced Copper Alloys. A method of forming an environmental-resistant thermal barrier coating on a copper alloy is disclosed. The steps include cleansing a surface of a copper alloy, depositing a bond coat on the cleansed surface of the copper alloy, depositing a NiAl top coat on the bond coat and consolidating the bond coat and the NiAl top coat to form the thermal barrier coating. The bond coat may be a nickel layer or a layer composed of at least one of copper and chromium-copper alloy and either the bond coat or the NiAl top coat or both may be deposited using a low pressure or vacuum plasma spray.

US 6,838,191. S.V. Raj. Company: NASA. Issued/Filed: Jan 4, 2005/May 20, 2003.

Honeycomb Structure Thermal Barrier Coating. A device having an improved thermal barrier coating and a process for manufacturing the same. A support structure for retaining a ceramic insulating material on a substrate is formed by the deposition of a support structure material through a patterned masking material. The support structure can define cells into which the ceramic insulating material is deposited following removal of the masking material. The masking material may be patterned by known photolithographic techniques or by laser etching. The support structure may be a composite metal-ceramic material having either discreet layers or a graded composition and may be deposited by an electrodeposition process followed by a heat treatment to form a solid-state diffusion bond with the substrate. The ceramic filler material may be deposited by the electrophoretic deposition of ceramic particles coated with a bonding material that is subsequently heated to oxidize and to bond the particles together. The support structure may be provided with included walls to improve its resistance to foreign object impact damage.

US 6,846,574. R. Subramanian. Company: Siemens Westinghouse Power Corporation. Issued/Filed: Jan 25, 2005/May 16, 2001.

Method and Apparatus for Instrumenting a Gas Turbine Component Having a Barrier Coating. A method of instrumenting a component having a barrier coating. A sensor is embedded within or below the coating. Material forming the sensor is deposited within a trench formed into the barrier coating. The trench is then backfilled with material to protect the sensor from the environment within which the component is operating. In this manner, the sensor may be embedded at any desired location and any desired depth within a barrier coating on a previously fabricated component. An array of sensors may be embedded across the depth of the coating to provide signals indicative of operating conditions across the coating. The signals may be conducted to a connection location by conductors that are deposited within the trench. The trench may be formed with a laser engraving process and the material for the sensor and conductors may be deposited with a selective laser melting process.

US 6,838,157. R. Subramanian. Company: Siemens Westinghouse Power Cor-

poration. Issued/Filed: Jan 4, 2005/Sept 23, 2002.

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 6,866,897. H. Wang, D.J. Mitchell, Y.-Ch. Lau, and A.T. Henry. Company: General Electric Co. Issued/Filed: March 15, 2005/Sept 30, 2002.

Process for Depositing a Bond Coat for a Thermal Barrier Coating System. A method of depositing a bond coat of a thermal barrier coating (TBC) system for components designed for use in a hostile thermal environment, such as turbine, combustor, and augmentor components of a gas turbine engine. The method yields a bond coat having an adequate surface roughness for adhering a plasma sprayed ceramic layer while also producing a bond coat that is dense with low porosity, thereby yielding a thermal barrier coating system that is highly resistant to spallation. The method generally entails forming the bond coat by depositing two metal powders on the substrate using either a vacuum plasma spraying (VPS) or high velocity oxyfuel (HVOF) technique. The particle size distributions of the two powders are chosen to yield a bimodal (dual-peak) particle size distribution that will produce a VPS and HVOF bond coat characterized by a macrosurface roughness of at least about 350 μin R_a attributable to particles of the coarser powder. The particles of the finer powder fill the interstices between particles of the coarser powder to achieve a density of at least about 95% of theoretical density and contribute to a microsurface roughness that, in combination with the macrosurface roughness provided by the coarser particles, enhances adhesion of the ceramic layer.

EP 909,831. X.M. Zheng. Company: General Electric Co. Issued/Filed: Jan 26, 2005/Sept 22, 1998.

Spray Coated Member Resistant to High-Temperature Environment and Method of Production Thereof. To advantageously solve problems such as lowering of the productivity, contamination of alloy coating due to the adoption of different metal, increase of the cost due to the adoption of different coating process, a coating of MCrAlX alloy containing an oxide such as CoO, NiO, or the like is directly formed at a thickness of 10-500 μm through a low-pressure plasma spraying process containing substantially no oxide and thereafter the same MCrAlX alloy containing no oxide is applied thereonto at a thickness of 100-800 μm through a low-pressure plasma spraying process in a nonoxidizing atmosphere to form a composite sprayed coating.

EP 919,639. Y. Harada, T. Suizu, and T. Teratani. Company: Tocalo Co. Ltd. Issued/Filed: Feb 9, 2005/March 23, 1998.

Thermal Barrier Coatings with Improved Impact and Erosion Resistance. A reduced thermal conductivity thermal barrier coating having improved impact and erosion resistance for an underlying metal substrate of articles that operate at, or are exposed to, high temperatures. This coating comprises a zirconia-containing ceramic composition having a c/a ratio in the range of from about 1.0117 to about 1.0148 and stabilized in the tetragonal phase by a stabilizing amount of a stabilizer metal oxide. The coating has a fraction of porosity of from about 0.10 to about 0.25, and an impact and erosion resistance property defined by at least one of the following formulas: (a) $I = \exp[5.85 - (144 \times s) - (3.68 \times p)]$ and/or (b) $E = [187 - (261 \times p) - (9989 \times s)]$, wherein $s = 1.0117 - c/a$ ratio, p is the fraction of porosity, I is least about 140 g/mil, and E is least about 130 g/mil. 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 depositing the zirconia-containing ceramic composition on the bond coat layer, or the metal substrate in the absence of the bond coat layer.

US 6,869,703. I. Spitsberg and B.A. Boutwell. Company: General Electric Company. Issued/Filed: March 22, 2005/ Dec 30, 2003.