

Title (en)

THE FORMATION METHOD OF POROUS ANTIBACTERIAL COATINGS ON TITANIUM AND TITANIUM ALLOYS SURFACE

Title (de)

VERFAHREN ZUR HERSTELLUNG VON PORÖSEN ANTIKÄTERIELLEN BESCHICHTUNGEN AUF DER OBERFLÄCHE VON TITAN UND TITANLEGIERUNGEN

Title (fr)

PROCÉDÉ DE FORMATION DE REVÊTEMENTS ANTIBACTÉRIENS POREUX SUR UNE SURFACE DE TITANE ET D'ALLIAGES DE TITANE

Publication

EP 3816327 A1 20210505 (EN)

Application

EP 20460021 A 20200505

Priority

PL 43037419 A 20190625

Abstract (en)

The method of titanium surface modification by plasma electrochemical oxidation in Ca(H₂PO₂)₂ baths at a concentration from 0.01 mol·dm⁻³ to 5 mol·dm⁻³ with an anodic current density from 1 mA·cm⁻² to 250 mA·cm⁻² and applied voltage from 50 V to 600 V is characterized by immersing the surface-modified element in an aqueous salt solution with insoluble particles of metal phosphate at a concentration from 1 g·dm⁻³ to 400 g·dm⁻³.

IPC 8 full level

C25D 11/02 (2006.01); **C25D 11/26** (2006.01)

CPC (source: EP)

C25D 11/026 (2013.01); **C25D 11/26** (2013.01)

Citation (applicant)

- CN 101899700 A 20101201 - UNIV JIAMUSI
- CN 108543109 A 20180918 - HUAIYIN INST TECHNOLOGY
- CN 103911644 A 20140709 - UNIV JIANGXI NORMAL SCI & TECH
- CN 103526261 A 20140122 - ZHAO QUANMING
- CN 107376897 A 20171124 - UNIV SOUTH CHINA TECH
- PL 225226 A1 19820104 - ZAKLADY WYTWCZE URZADZEN SYG [PL]
- PL 225227 A1 19820104 - CT KT MASZYN GORNICZYCH KOMAG [PL]
- PL 396115 A1 20130304 - POLITECHNIKA SLASKA IM WINCENT [PL]
- PL 214630 B1 20130830 - POLITECHNIKA SLASKA IM WINCENT [PL]
- W.H. SONGH.S. RYUSH.H. HONG: "Antibacterial properties of Ag (or Pt)-containing , calcium phosphate coatings formed by micro-arc oxidation", JOURNAL OF BIOMEDICAL MATERIALS RESEARCH PART A, vol. 88, no. 1, 2009, pages 246
- S. FERRARISS. SPRIANO: "Antibacterial titanium surfaces for medical implants", MATERIALS SCIENCE AND ENGINEERING, vol. 61, 2016, pages 965
- S. FIDANF. MUHAFFELM. RIOOLG. CEMPURAL. DE BOERS. A. J ZAATA. CZYRSKA-FILEMONOWICZH. CIMENOGLU: "Fabrication of oxide layer on zirconium by micro-arc oxidation: Structural and antimicrobial characteristics", MATERIALS SCIENCE AND ENGINEERING, vol. 71, 2017, pages 565
- F. MUHAFFELG. CEMPURAM. MENEKSEA. CZYRSKA-FILEMONOWICZN. KARAGULERH. CIMENOGLU: "Characteristics of multi-layer coatings synthesized on Ti6Al4V alloy by micro-arc oxidation in silver nitrate added electrolytes", SURFACE AND COATING TECHNOLOGY, vol. 307, 2016, pages 308, XP029823815, DOI: 10.1016/j.surcoat.2016.09.002
- S. RYUSH HONG: "Corrosion Resistance and Antibacterial Properties of Ag-Containing MAO Coatings on AZ31 Magnesium Alloy Formed by Microarc Oxidation", JOURNAL OF ELECTROCHEMICAL SOCIETY, vol. 157, 2010, pages 131
- C. CHANGX. HUANGY. LIUL. BAIX. YANGR. HANGB. TANGPK CHU: "High-current anodization: A novel strategy to functionalize titanium-based biomaterials", ELECTROCHIMICA ACTA, vol. 173, 2015, pages 345, XP029209963, DOI: 10.1016/j.electacta.2015.05.075
- B.S. NECULAL.E. FRATILA-APACHITEIS.A. ZAATI. APACHITEIJ. DUSZCZYK: "In vitro antibacterial activity of porous TiO₂-Ag composite layers against methicillin-resistant Staphylococcus aureus", ACTA BIOMATERIALIA, vol. 5, 2009, pages 3573, XP026693830, DOI: 10.1016/j.actbio.2009.05.010
- D. TEKERF. MUHAFFELM. MENEKSENG KARAGULERH. BAYDOGANH. CIMENOGLU: "Characteristics of multi-layer coating formed on commercially pure titanium for biomedical applications", MATERIALS SCIENCE AND ENGINEERING C, vol. 48, 2015, pages 579
- X. ZHANGH. WANGJ. LIX. HER. HANGX. HUANGL. TIANB. TANG: "Corrosion behaviour of Zn-incorporated antibacterial TiO₂ porous coating on titanium", CERAMIC INTERNATIONAL, vol. 32, 2016, pages 919
- K. ROKOSZT. HRYNIEWICZL. DUDEKA. SCHUTZJ. HEEGM. WIENECKE: "Energy-Dispersive X-Ray Spectroscopy Mapping of Porous Coatings Obtained on Titanium by Plasma Electrolytic Oxidation in a Solution Containing Concentrated Phosphoric Acid with Copper Nitrate", ADVANCES IN MATERIALS SCIENCE, vol. 16, 2016, pages 15
- I.V. LUKIYANCHUKI.V. CHERNYKH.V. RUDNEVA. YU USTINOV.L.M. TYRINAP.M. NEDOZOROVE.E. DMITRIEVA: "Catalytically active cobalt-copper-oxide layers on aluminium and titanium", PROTECTION OF METALS AND PHYSICAL CHEMISTRY OF SURFACES, vol. 50, 2014, pages 209
- W. ZHUZ. ZHANGJ. GUJ. SUNL. ZHU: "Biological Activity and Antibacterial Property of Nano-structured TiO₂ Coating Incorporated with Cu Prepared by Micro-arc Oxidation", JOURNAL OF MATERIALS SCIENCE & TECHNOLOGY, vol. 29, 2013, pages 237
- K. ROKOSZT. HRYNIEWICZD. MATYSEKS. RAAENJ. VALICEKL. DUDEKM. HARNICAROVA: "SEM, EDS and XPS Analysis of the Coatings , Obtained on Titanium after Plasma Electrolytic Oxidation in Electrolytes Containing Copper Nitrate", MATERIALS, vol. 9, 2016, pages 318
- X. YAOX. ZHANGH. WUL. TIANY. MAB. TANG: "Microstructure and antibacterial properties of Cu-doped TiO₂ coating on titanium by micro-arc oxidation", APPLIED SURFACE SCIENCE, vol. 292, 2014, pages 944
- X. HUANGY. LIUH. YUX. YANGY. WANGR. HANGB. TANG: "One-step fabrication of cytocompatible micro/nano-textured surface with TiO₂ mesoporous arrays on titanium by high current anodization", ELECTROCHIMICA ACTA, vol. 199, 2016, pages 116, XP029510966, DOI: 10.1016/j.electacta.2016.03.119
- L. ZHANGJ. GUOX. HUANGY. ZHANGY. HAN: "The dual function of Cu-doped TiO₂ coatings on titanium for application in percutaneous implants", JOURNAL OF MATERIALS CHEMISTRY, vol. 4, 2016, pages 3788
- H. HUW. ZHANGY. QIAOX. JIANGX. LIUC. DING: "Antibacterial activity and increased bone marrow stem cell functions of Zn-incorporated TiO₂ coatings on titanium", ACTA BIOMATERIALIA, vol. 8, 2012, pages 904

- K. ROKOSZT. HRYNIEWICZK. PIETRZAKW. MALORNY: "SEM and EDS Characterization of Porous Coatings Obtained On Titanium by Plasma Electrolytic Oxidation in Electrolyte Containing Concentrated Phosphoric Acid with Zinc Nitrate", ADVANCES IN MATERIALS SCIENCE, vol. 17, 2017, pages 41
- Q. HONGLEIL. CHENY. XIWENW. MINGYUEY. ZONGCHENG: "Preparation and photocatalytic performance of Zn₀/WO_x/TiO₂ composite coatings formed by plasma electrolytic oxidation", JOURNAL OF MATERIALS SCIENCE: MATERIALS IN ELECTRONICS, vol. 29, 2018, pages 2060
- A. BORDBAR-KHIABANIB. YARMANDM. MOZAFARI: "Enhanced corrosion resistance and in-vitro biodegradation of plasma electrolytic oxidation coatings prepared on AZ91 Mg alloy using ZnO nanoparticles-incorporated electrolyte", SURFACE AND COATINGS TECHNOLOGY, vol. 360, 2019, pages 153
- Q. DUD. WEIY. WANGS. CHENG. LIUY. ZHOUD. JIA: "The effect of applied voltages on the structure, apatite-inducing ability and antibacterial ability of micro arc oxidation coating formed on titanium Surface", BIOACTIVE MATERIALS, vol. 3, 2018, pages 426
- L. SOPCHENSKI. POPATP. SOARES: "Bactericidal activity and cytotoxicity of a zinc doped PEO titanium coating", THIN SOLID FILMS, vol. 660, 2018, pages 477, XP085440169, DOI: 10.1016/j.tsf.2018.05.055

Citation (search report)

- [A] PL 214958 B1 20131031 - POLITECHNIKA ŚLĄSKA IM WINCENT [PL]
- [A] CN 102677125 A 20120919 - NW INST NON FERROUS METAL RES
- [A] KAZEK-KESIK ALICJA ET AL: "Surface characterisation of Ti-15Mo alloy modified by a PEO process in various suspens", MATERIALS SCIENCE AND ENGINEERING C, vol. 39, 12 March 2014 (2014-03-12), pages 259 - 272, XP029029210, ISSN: 0928-4931, DOI: 10.1016/J.MSEC.2014.03.008
- [AD] NECULA B S ET AL: "In vitro antibacterial activity of porous TiO₂-Ag composite layers against methicillin-resistant Staphylococcus aureus", ACTA BIOMATERIALIA, ELSEVIER, AMSTERDAM, NL, vol. 5, no. 9, 1 November 2009 (2009-11-01), pages 3573 - 3580, XP026693830, ISSN: 1742-7061, [retrieved on 20090518], DOI: 10.1016/J.ACTBIO.2009.05.010
- [A] DATABASE EPODOC [online] EUROPEAN PATENT OFFICE, THE HAGUE, NL; 20 May 1996 (1996-05-20), XP002800828, Database accession no. RU-94028190-A & RU 94028190 A 19960520 - INST KHM DAL NEVOSTOCHNOGO OTDEL RAN
- [AD] MUHAFFEL FAIZ ET AL: "Characteristics of multi-layer coatings synthesized on Ti6Al4V alloy by micro-arc oxidation in silver nitrate added electrolytes", SURFACE AND COATINGS TECHNOLOGY, ELSEVIER BV, AMSTERDAM, NL, vol. 307, 1 September 2016 (2016-09-01), pages 308 - 315, XP029823815, ISSN: 0257-8972, DOI: 10.1016/J.SURFCOAT.2016.09.002

Designated contracting state (EPC)

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

Designated extension state (EPC)

BA ME

DOCDB simple family (publication)

EP 3816327 A1 20210505; EP 3816327 B1 20231018; EP 3816327 B8 20231220; PL 239584 B1 20211220; PL 3816327 T3 20240318; PL 430374 A1 20200713

DOCDB simple family (application)

EP 20460021 A 20200505; PL 20460021 T 20200505; PL 43037419 A 20190625