



---

**Nuevo tratamiento de oxidación en aleaciones de NiTi  
para aplicaciones biomédicas. Caracterización  
superficial y respuesta biológica *in vitro***

---

**Alexandra Michiardi**

Memoria de Tesis presentada para optar al grado de Doctor por la  
Universitat Politècnica de Catalunya

Co-dirigida por  
Profesor Francisco Javier Gil Mur  
Dr. Conrado José Aparicio Bádenas

Departament de Ciència dels Materials i Enginyeria Metal·lúrgica  
E.T.S. d'Enginyeria Industrial de Barcelona  
Universitat Politècnica de Catalunya

Diciembre 2005

## Referencias

- [Aam93] Azula F.J., Alonso R., Marino A., Trueba M., Macarulla J.M. "Ni<sup>2+</sup> Impairs Thrombin-Induced Signal-Transduction by Acting on the Agonist and Or Receptor in Human Platelets", *American Journal of Physiology*, 265:C1681-C1688 (1993)
- [Aam02] Atmani H., Audrain C., Mercier L., Chappard D., Basle M.F. "Phenotypic effects of continuous or discontinuous treatment with dexamethasone and/or calcitriol on osteoblasts differentiated from rat bone marrow stromal cells". *Journal of Cellular Biochemistry*, 85:640-650 (2002)
- [Abi05] Anselme K., Bigerelle M. "Topography effects of pure titanium substrates on human osteoblast long-term adhesion", *Acta Biomaterialia*, 1(2):211-222 (2005)
- [Abn00] Anselme K., Bigerelle M., Noel B., Dufresne E., Judas D., Iost A., Hardouin P. "Qualitative and quantitative study of human osteoblast adhesion on materials with various surface roughness", *Journal of Biomedical Materials Research*, 49:155-166 (2000)
- [Aca00] Ariza Camacho M.J. "Caracterización electrocinética y química de las superficies de membranas poliméricas mediante potencial de flujo y espectroscopia de fotoelectrones de rayos X", Tesis Doctoral, Universidad de Málaga (2000)
- [Acf01] Aziz-Kerzo M., Conroy K.G., Fenelson A.M., Farrell S.T., Breslin C.B. "Electrochemical studies on the stability and corrosion resistance of titanium-based implant materials". *Biomaterials*, 22:1531-1539 (2001)
- [Agp02] Aparicio C., Gil F.J., Planell J.A, Engel E. "Human-osteoblast proliferation and differentiation on grit-blasted and bioactive titanium for dental applications" *Journal of Materials Science-Materials in Medicine* 13:1105-1111 (2002)
- [Agr03] Armitage D.A, Grant D.M. "Characterisation of surface-modified nickel titanium alloys", *Materials Science and Engineering A*, 349:89-97 (2003)
- [Agr94] Altankov G., Groth T. "Reorganization of Substratum-Bound Fibronectin on Hydrophilic and Hydrophobic Materials Is Related to Biocompatibility", *Journal of Materials Science-Materials in Medicine*, 5:732-737 (1994)
- [Alb94] Assad M., Lombardi S., Berneche S., Desrosiers E.A., Yahia L'H., Rivard C.H. "Essais de cytotoxicité sur l'alliage à mémoire de forme nickel-titane", *Annales de Chirurgie*, 48:731-736 (1994)
- [Alr99] Assad M., Lemieux N., Rivard C.H., Yahia L'H. "Comparative *in vitro* biocompatibility of nickel-titanium, pure Ni, pure Ti, and stainless steel: genotoxicity and atomic absorption evaluation", *Bio-Medical Materials Engineering*, 9:1-12 (1999)
- [Ans00] Anselme K. "Osteoblast adhesion on biomaterials", *Biomaterials*, 21:667-681 (2000)

- [**Apa04**] Aparicio C. "Tratamientos de superficie sobre titanio comercialmente puro para la mejora de la osteointegración de los implantes dentales", Tesis Doctoral, Universidad Politècnica de Catalunya, Barcelona (2004)
- [**Apa93**] Amiji M., Park K. "Surface Modification of Polymeric Biomaterials with Poly(Ethylene Oxide), Albumin, and Heparin for Reduced Thrombogenicity", *Journal of Biomaterials Science-Polymer Edition*, 4:217-234 (1993)
- [**Apg03**] Armitage D.A., Parker T.L, Grant D.M. "Biocompatibility and hemocompatibility of surface-modified NiTi alloys", *Journal of Biomedical Materials Research*, 66A:129-137 (2003)
- [**App99**] Armitage D., Parker K., Parker T., Grant D. "Platelet response to nickel titanium". Conference Proceeding, International Conference on Shape Memory and Superelastic Technologies, pp 226-239, Antwerpen, Belgium (1999)
- [**ASME B46.1-1995**] Surface Texture (Surface Roughness, Waviness and Lay)
- [**ASTM E673-90**] "Standard terminology relating to surface analysis", *Surface and Interface Analysis*, 17:951-958 (1991), reimpresión permitida del Annual Book of ASTM Standards, American Society for Testing and Materials
- [**ASTM F746**] Standard test method for pitting or crevice corrosion of metallic surgical implant materials (2004)
- [**ASTM G31-90**] Standard practice for laboratory immersion corrosion testing metals (1990)
- [**ASTM G61-86**] Standard test method for conducting cyclic potentiodynamic polarization measurements for localized corrosion susceptibility of iron-nickel or cobalt-based alloys (1986)
- [**Atg00**] Altankov G., Thom V., Groth T., Jankova K., Jonsson G., Ulbricht M. "Modulating the biocompatibility of polymer surfaces with poly(ethylene glycol): Effect of fibronectin". *Journal of Biomedical Materials Research*, 52:219-30 (2000)
- [**Ayr98**] Assad M., Yahia L'H., Rivard C.H., Lemieux N. "In vitro biocompatibility assessment of a nickel-titanium alloy using electron microscopy in situ end-labeling (EM-ISEL)", *Journal of Biomedical Materials Research*, 41:154-161 (1998)
- [**Azn87**] Absolom D.R., Zingg W., Neumann A.W. "Protein Adsorption to Polymer Particles - Role of Surface-Properties", *Journal of Biomedical Materials Research*, 21:161-171 (1987)
- [**Bad02**] Bigerelle, M., Anselme K., Dufresne E., Hardouin P., Iost A. "An unscaled parameter to measure the order of surfaces: a new surface elaboration to increase cells adhesion", *Biomolecular Engineering*, 19:79-83 (2002)
- [**Bai96**] Bailey G.S. "The chloramine T method for radiolabeling protein", in *The protein protocols handbook*, pp 665-667, Walter J.M., ed., Humana Press, Totowa, N.J., (1996)
- [**Bbk98**] Boyan B.D., Batzer R., Kieswetter K., Liu Y., Cochran D.L., Szmuckler-Moncler S., Dean D.D., and Schwartz Z. "Titanium surface roughness alters responsiveness of MG63 osteoblast-like cells to 1 alpha,25-(OH)(2)D-3", *Journal of Biomedical Materials Research*, 39:77-85 (1998)

- [Bbr96] Berger-Gorbet M., Broxup B., Rivard C., Yahia L'H. "Biocompatibility testing of NiTi screws using immunohistochemistry on sections containing metallic implants", *Journal of Biomedical Materials Research*, 32:243-248 (1996)
- [Bbx01] Buttery L.D.K., Bourne S., Xynos J.D., Wood H., Hughes F.J., Hughes S.P.F., Episkopou V., Polak J.M. "Differentiation of osteoblasts and in vitro bone formation from murine embryonic stem cells", *Tissue Engineering*, 7:89-99 (2001)
- [Bgr03] Briggs D., Grant J.T., eds. *Surface Analysis by Auger and X-Ray Photoelectron Spectroscopy*, Surface Spectra Ltd, IM Publications (2003)
- [Bgw63] Buehler W.J., Gilfrich J.W., Willey R.C. "Effect of low temperature phase changes on the mechanical properties of alloys near composition NiTi", *Applied Physics*, 34:1475 (1963)
- [Bho86] Bohnert J.L., Horbett T.A. "Changes in Adsorbed Fibrinogen and Albumin Interactions with Polymers Indicated by Decreases in Detergent Elutability", *Journal of colloid and Interface Science*, 111:363-378 (1986)
- [Bks92] Bonewald L.F., Kester M.B., Schwartz Z., Swain L.D., Khare A., Johnson T.L., Leach R.J., Boyan, B.D. "Effects of Combining Transforming Growth-Factor-Beta and 1,25-Dihydroxyvitamin-D3 on Differentiation of A Human Osteosarcoma (MG-63)", *Journal of Biological Chemistry*, 267:8943-8949 (1992)
- [Bla87] Biedermann K. A. and Landolph J. R. "Induction of Anchorage Independence in Human-Diploid Foreskin Fibroblasts by Carcinogenic Metal-Salts", *Cancer Research*, 47:3815-3823 (1987)
- [Bla99] Black J. "Allergic foreign-body response", en *Biological performance of materials*, 2<sup>nd</sup> edition. *Fundamentals of biocompatibility*, Capitulo 11, p.184, Marcel Dekker, New-York (1999)
- [Bla99b] Black J. "Biological performance of materials", 2<sup>nd</sup> edition, en *Fundamentals of biocompatibility*, Marcel Dekker, New-York (1999)
- [Bld01] Boyan B.D., Lohmann C.H., Dean D.D, Sylvia V.L., Cochran D.L., and Schwartz Z. "Mechanisms involved in osteoblast response to implant surface morphology", *Annual Reviews in Materials Research*, 31:357-371 (2001)
- [Bly80] Baszkin A., Lyman D.J. "The Interaction of Plasma-Proteins with Polymers. 1. Relationship Between Polymer Surface-Energy and Protein Adsorption-Desorption". *Journal of Biomedical Materials Research*, 14:393-403 (1980)
- [Bmy00] Barras C.D.J. "Nitinol- Its use in vascular surgery and other applications", *European Journal of Vascular and Endovascular Surgery*, 19:564-569 (2000)
- [Boh92] Baker H., Okamoto H., Henry S.D. *ASM Handbook*, Vol 3: Alloy phase diagrams, pp 2-319, ASM International (1992)

- [Brg00] Browne M., Gregson P.J. "Effect of mechanical surface pre-treatment on metal ion release". *Biomaterials*, 21:385-392 (2000)
- [Bsa98] Boscolo P., Sabbioni E., Andreassi P., Di Giacomo F., Giaccio M., DiGiacchino M. "Immune parameters and blood and urine trace elements in nonallergic and nickel-sensitised humans", en *Metal ions in biology and medicine*, Colley P., Brätter P., Negretti de Brätter V., Khassanova L., Etienne J.-C., eds, John Libbey Eurotext:545-555 (1998)
- [Bsl99] Boyan B.D., Sylvia V.L., Liu Y., Sagun R., Cochran D.L., Lohmann H., Dean D.D., Schwartz Z. "Surface roughness mediates its effects on osteoblasts via protein kinase A and phospholipase A2", *Biomaterials*, 20:2305-2310 (1999)
- [Btr02] ter Brugge P.J., Torensma R., De Ruijter J.E., Figdor C.G., Jansen J.A. "Modulation of integrin expression on rat bone marrow cells by substrates with different surface characteristics", *Tissue Engineering*, 8:615-26 (2002)
- [Bwa67] Buehler W.J., Wang F.E. "A summary of recent research on the Nitinol alloys and their potential application in ocean engineering", *Ocean Engineering*, 1:105-120 (1967)
- [Caa03] Cederbrant K., Anderson C., Andersson T., Marcusson-Stahl M., and Hultman, P. "Cytokine production, lymphocyte proliferation and T-Cell receptor V beta expression in primary peripheral blood mononuclear cell cultures from nickel-allergic individuals", *International Archives of Allergy and Immunology*, 132:373-379 (2003)
- [Cas03] Casals J., *resultados internos no publicados*, Laboratorio de Biomateriales, Biomecánica e Ingeniería de tejidos, UPC, Barcelona (2003)
- [Ccb95] Chesmel K.D., Clark C.C., Brighton C.T., Black J. "Cellular-responses to chemical and morphologic aspects of biomaterial surfaces , 2: the biosynthetic and migratory response of bone cell-populations", *Journal of Biomedical Materials Research*, 29:1101-1110 (1995)
- [Cmo81] Castleman L.S., Motzkin S.M. "The biocompatibility of Nitinol", en *Biocompatibility of clinical implant materials*, eds Williams D.F., CRC Press, Boca Raton, Florida:129-154 (1981)
- [Cps05] Carinci F., Pezzetti F., Spina A.M., Palmieri A., Laino G., De Rosa A., Farina E., Illiano F., Stabellini G., Perrotti V., Piattelli A. "Effect of Vitamin C on pre-osteoblast gene expression", *Archives of Oral Biology* 50:481-496 (2005)
- [Cra02] Castner D.G., Ratner B.D. "Biomedical surface science: Foundations to frontiers", *Surface Science*, 500:28-60 (2002)
- [Csm04] Cheng F.T., Shi P., Man H.C. "A preliminary study of TiO<sub>2</sub> deposition on NiTi by a hydrothermal method", *Surface and Coatings Technology*, 187:26-32 (2004)
- [Ctd90] Chan C.M., Trigwell S., Duerig T. "Oxidation of a NiTi alloy." *Surface and Interface Analysis*, 15:349-354 (1990)

- [Cvj01] Cejna M., Vermani R., Jones R., Bergmeister H., Losert U., Xu Z., Yang P., Schoder M., Lammer J. "Biocompatibility and performance of wall stent and several covered stents in a sheep iliac artery model", *Journal of Vascular and Interventional Radiology*, 12:351-358 (2001)
- [Dbs97] Dewez J.L., Berger V., Schneider Y.J., Rouxhet P.G. "Influence of substrate hydrophobicity on the adsorption of collagen in the presence of pluronic F68, albumin, or calf serum", *Journal of colloid and Interface Science*, 191:1-10 (1997)4.
- [Dca79] DiPaolo J.A., Casto B.C. "Quantitative studies of in vitro morphological transformation of Syrian hamster cells by inorganic metal salts", *Cancer Research*, 39:1008-1013 (1979)
- [Dkl01] Deligianni D.D., Katsala N., Ladas S., Sotiropoulou D., Amedee J., Missirlis Y.F. "Effect of surface roughness of the titanium alloy Ti6Al4V on human bone marrow cell response and on protein adsorption", *Biomaterials*, 22:1241-1251 (2001)
- [Dmc95] DalleDonne I., Milzani A., Colombo R. "H<sub>2</sub>O<sub>2</sub>-treated actin: Assembly and polymer interactions with cross-linking proteins", *Biophysical Journal*, 69: 2710-2719 (1995)
- [Dmg98] Dalton B.A., McFarland C.D., Gengenbach T.R., Griesser H.J., Steele J.G. "Polymer surface chemistry and bone cell migration", *Journal of Biomaterials Science-Polymer Edition*, 9:781-799 (1998).
- [Dms90] Duerig T.W., Melton K.N., Stöckel D., Wayman C.M. *Engineering aspects of shape memory alloys*, Ed. Butterworth-Heinemann Ltd (1990)
- [Dmu95] Dalton B.A., McFarland C.D., Underwood P.A., Steele J.G. "Role of the Heparin-Binding Domain of Fibronectin in Attachment and Spreading of Human Bone-Derived Cells", *Journal of Cell Science*, 108:2083-2092 (1995)
- [Dpe94] Duerig T.W., Pelton A.R., "NiTi shape memory alloys", en *Materials Properties Handbook: Titanium Alloys*, ASM International, Boyer R., Welsch G., Collings E.W, eds, pp 1035-1048 (1994)
- [Dsa02] Denkhaus E., Salnikow K. "Nickel essentiality, toxicity, and carcinogenicity", *Critical Reviews in Oncology/Hematology*, 42:35-56 (2002)
- [Dvb89] Dunlap C.L., Vincent S.K., Barker B.F. "Allergic reaction to orthodontic wire: report case", *JADA*, 118:449-450 (1989)
- [Eca83] Erickson H.P., Carrell N.A. "Fibronectin in extended and compact conformations - electron-microscopy and sedimentation analysis", *Journal of Biological Chemistry*, 258:4539-44 (1983)
- [Efg93] Espinós J.P., Fernández A., González-Elipse A.R. "Oxidation and diffusion processes in Nickel-Titanium oxide systems", *Surface Science*, 295:402-410 (1993)
- [Ela95] Elwing H.B., Li L., Askendal A.R., Nimeri G.S., Brash J.L. "Protein displacement phenomena in blood plasma and serum studied by the wettability gradient method and the lens-

- on-surface method”, in *Proteins at Interfaces II: fundamentals and applications*, Horbett T.A., Brash J.L., eds, Washington, DC: American Chemical Society, 602:138-149 (1995)
- [**Ell91**] Ellingsen J.E. “A Study on the Mechanism of Protein Adsorption to TiO<sub>2</sub>”. *Biomaterials*, 12:593-6 (1991)
- [**Fco91**] Fabrizio-Homan D.J., Cooper S.L. “Competitive adsorption of vitronectin with albumin, fibrinogen, and fibronectin on polymeric biomaterials”, *Journal of Biomedical Materials Research*, 25:953-971 (1991)
- [**Fkm97**] Filip K., Kneissl A., Mazanec K. “Physics of hydroxyapatite plasma coatings on TiNi shape memory materials”. *Materials Science Engineering*, A234-A236:422-425 (1997)
- [**Flm01**] Filip P., Lausmaa J., Musialek J., Mazanec K. “Structure and surface of NiTi human implants”. *Biomaterials* 22, 2131:2138 (2001)
- [**Fmu86**] Foulkes E.C., McMullen D.M. "On the Mechanism of Nickel Absorption in the Rat Jejunum", *Toxicology*, 38:35-42 (1986)
- [**Fvk02**] Firstov G.S., Vitchev R.G., Kumar H., Blanpain B., Van Humbeeck J. "Surface oxidation of NiTi shape memory alloy", *Biomaterials*, 23:4863-4871 (2002)
- [**Geg00**] García-Alonso M.C., Escudero M.L., González-Carrasco J.L., Chao J. “Effect of substrate roughness on the corrosion behaviour of the Al<sub>2</sub>O<sub>3</sub>/MA 956 system”. *Biomaterials* 21:79-87 (2000)
- [**Gfe81**] Grinnell F., Feld M.K. “Adsorption Characteristics of Plasma Fibronectin in Relationship to Biological-Activity”. *Journal of Biomedical Materials Research*, 15:363-81 (1981)
- [**Gfe82**] Grinnell F., Feld M.K. “Fibronectin Adsorption on Hydrophilic and Hydrophobic Surfaces Detected by Antibody-Binding and Analyzed During Cell-Adhesion in Serum-Containing Medium”. *Journal of Biological Chemistry*, 257:4888-93 (1982)
- [**Ggw97**] Green S.M., Grant G.M., Wood J.V. "XPS characterization of surface modified NiTi shape memory alloy", *Materials Science and Engineering*, A224:21-26 (1997)
- [**Gma02**] Gall K. and Maier H. "Cyclic deformation mechanisms in precipitated NiTi shape memory alloys", *Acta Materialia*, 50:4643-4657 (2002)
- [**Gmf97**] Gluszek J., Masalski J., Furman P., Nitsch K. “Structural and electrochemical examinations of PACVD TiO<sub>2</sub> films in Ringer solution”. *Biomaterials*, 18:789-794 (1997)
- [**Gpl99**] Gil F.J., Planell J.A. "Effect of copper addition on the superelastic behavior of Ni-Ti shape memory alloys for orthodontic applications", *Journal of Biomedical Materials Research*, 48:682-688 (1999)
- [**Haa98**] Hanawa T., Asami K., Asaoka K. "Repassivation of titanium and surface oxide film regenerated in simulated bioliquid", *Journal of Biomedical Materials Research*, 40:530-538 (1998)

- [Hbo01] Hallab N.J., Bundy K.J., O'Connor K., Moses R.L., Jacobs J.J. "Evaluation of metallic and polymeric biomaterials surface energy and surface roughness characteristics for directed cell adhesion", *Tissue Engineering*, 7:55-71 (2001)
- [Hcl03] Huang H.-H., Chiu Y.-H., Lee T.-H., Wu S.-C., Yang H.-W., Su K.-H., Hsu C.-C., "Ion release from NiTi orthodontic wires in artificial saliva with various acidities", *Biomaterials*, 24:3585-3592 (2003)
- [Hdm97] Hayoz D., Do D.D., Mahler F., Triller J., Spertini F. "Acute inflammatory reaction associated with endoluminal bypass grafts", *Journal of Endovascular Surgery*, 4:354-360 (1997)
- [Hew94] Howlett C.R., Evans M.D.M, Walsh W.R., Johnson G., Steele J.G. "Mechanism of initial attachment of cells derived from human bone to commonly used prosthetic materials during cell-culture", *Biomaterials*, 15:213-222 (1994)
- [Hgb60] Helmkamp R.W., Goodland R.L., Bale W.F., Spar I.L., Mutschler L.E. "High specific activity iodination of gamma-globulin with iodine-131 monochloride", *Cancer Research*, 20 (10): 1495-1500 (1960)
- [Hkk02] Himeno T., Kawashita M., Kim H.M., Kokubo T., Nakamura T. "Zeta-potential variation of bioactive titanium metal during apatite formation on its surface in simulated body fluid", *Key Engineering Materials*, 218-220:641-644 (2002)
- [Hlo02] Horowitz M.C. and Lorenzo J.A., Local regulators of bone, IL-1, TNF, lymphotoxin, interferon- $\gamma$ , IL-8, IL-10, IL-4, the LIF/IL-6 family, and additional cytokines, en *Principle of Bone Biology*, eds Bilezikian J.P., Raisz L.G., Rodan G.A., Academic Press, Second Edition, Vol 2, Chap 53: 961-977 (2002)
- [Hlo02] Horowitz M.C., Lorenzo J.A. "Local regulators of bone", Capítulo 53 en *Principles of Bone Biology*, Volumen 2, Second Edition, Bilezikian J.P., Raisz L.G., Rodan G.A., eds., Academic Press (2002)
- [Hno94] Haynes C.A., Norde W. "Globular proteins at solid/liquid interfaces", *Colloids and Surfaces B: Biointerfaces*, 2:517-566 (1994)
- [Hor96] Horbett T.A. "Proteins: structure, properties and adsorption to surfaces", in *Biomaterials Science*, pp 133-141, Academia Press (1996)
- [Hot92] Hanawa T., Ota M. "Characterization of surface film formed on titanium in electrolyte using XPS", *Applied Surface Science*, 55:269-276 (1992)
- [Hsc88] Horbett T.A., Schway M.B. "Correlations between Mouse 3T3 Cell Spreading and Serum Fibronectin Adsorption on Glass and Hydroxyethylmethacrylate-Ethylmethacrylate Copolymers", *Journal of Biomedical Materials Research*, 22:763-793 (1988)
- [Hsr85] Horbett T.A., Schway M.B., Ratner B.D. "Hydrophilic-hydrophobic copolymers as cell substrates - effect on 3t3 cell-growth rates", *Journal of Colloid and Interface Science*, 104(1):28-39 (1985)



- [Htr96] Healy K.E., Thomas C.H., Rezania A., Kim J.E., McKeown P.J., Lom B., Hockberger P.E. "Kinetics of bone cell organization and mineralization on materials with patterned surface chemistry", *Biomaterials*, 17:195-208 (1996)
- [Ikh04] Igarashi M., Kamiya N., Hasegawa M., Kasuya T., Takahashi T., Takagi M. "Inductive effects of dexamethasone on the gene expression of Cbfa1, osterix and bone matrix proteins during differentiation of cultured primary rat osteoblasts", *Journal of Molecular Histology*, 35:3-10 (2004)
- [ISO 10993/EN 30993] International Organization for Standardization/European Committee for Standardization. Biological evaluation of medical devices (1994)
- [ISO 4287-1997] Geometrical Product Specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters.
- [Jee01] Jee W.S.S. "Integrated bone tissue physiology: anatomy and physiology", en *Bone Mechanics Handbook*, second edition, Cowin S.C., ed., CRC Press, 1-18 (2001)
- [Jil82] Jonsson U., Ivarsson B., Lundstrom I., Berghem L. "Adsorption Behavior of Fibronectin on Well-Characterized Silica Surfaces", *Journal of colloid and Interface Science*, 90:148-163 (1982)
- [Kas95] Kasprzak K.S. "Possible Role of Oxidative Damage in Metal-Induced Carcinogenesis", *Cancer Investigation*, 13:411-430 (1995)
- [Kcg04] Keselowsky B.G., Collard D.M., García A.J. "Surface chemistry modulates focal adhesion composition and signaling through changes in integrin binding", *Biomaterials*, 25:5947-5954 (2005)
- [Kdl02] Kapanen A., Danilov A., Lehenkari P., Ryhänen J., Jämsä T., Tuukkanen J. "Effect of metal alloy surface stresses on the viability of ROS-17/2.8 osteoblastic cells", *Biomaterials*, 23:3733-40 (2002)
- [Kfc91] Klein C.B., Frenkel K., Costa M. "The Role of Oxidative Processes in Metal Carcinogenesis", *Chemical Research in Toxicology*, 4:592-604 (1991)
- [Khk03] Kim H.M., Himeno T., Kawashita M., Lee J.H., Kokubo T., Nakamura T. "Surface potential change in bioactive titanium metal during the process of apatite formation in simulated body fluid", *Journal of Biomedical Materials Research*, 67A:1305-1309 (2003)
- [Kid02] Kapanen A., Ilvesaro J., Danilov A., Ryhänen J., Lehenkari P., Tuukkanen J.. "Behaviour of nitinol in osteoblast-like ROS-17 cell cultures", *Biomaterials*, 23:645-650 (2002)
- [Kkp97] Kellner W., Kuffer G., Pfluger T., Rosa F.T., Hahn K. "MR imaging of soft-tissue changes after percutaneous transluminal angioplasty and stent placement", *Radiology*, 202:327-331 (1997)
- [Kkr02] Kapanen A., Kinnunen A., Ryhänen J., Tuukkanen J. "TGF- $\beta$ 1 secretion of ROS-17/2.8 cultures on NiTi implant material", *Biomaterials*, 23:3341-3346 (2002)

- [Klh05] Khadra M., Lyngstadaas S.P., Haanaes H.R., Mustafa K. "Effect of laser therapy on attachment, proliferation and differentiation of human osteoblast-like cells cultured on titanium implant material". *Biomaterials*, 26:3503-9 (2005)
- [Knk05] Kowalczyńska H.M., Nowak-Wyrzykowska M., Kolos R., Dobkowski J., Kamiński J. "Fibronectin adsorption and arrangement on copolymer surfaces and their significance in cell adhesion", *Journal of Biomedical Materials Research*, 72:228-236 (2005)
- [Kos02] Kosmulski M. The significance of the difference in the point of zero charge between rutile and anatase, *Advances in Colloid and Interface Science*, 99:255-264 (2002)
- [Kos97] Kosmulski M. "Attempt to determine pristine points of zero charge of Nb<sub>2</sub>O<sub>5</sub>, Ta<sub>2</sub>O<sub>5</sub>, and HfO<sub>2</sub>", *Langmuir*, 13:6315-6320 (1997)
- [Kru79] Kruger J., "Fundamental aspects of the corrosion of metallic implants", en ASTM STP 684, Syrett B.C., Acharya A., Eds., American Society for Testing Materials, Baltimore, EEUU, pp 107-127 (1979)
- [Ksh96] Kieswetter K., Schwartz Z., Hummert T.W., Cochran D.L., Simpson J., Dean D.D., Boyan B.D. "Surface roughness modulates the local production of growth factors and cytokines by osteoblast-like MG63 cells", *Journal of Biomedical Materials Research*, 32:55-63 (1996)
- [Ksk97] Klinger A., Steinberg D., Kohavi D., Sela M.N. "Mechanism of adsorption of human albumin to titanium *in vitro*", *Journal of Biomedical Materials Research*, 36:387-392 (1997)
- [Lan93] Landolt D. "Corrosion et chimie de surfaces des métaux", Vol.12 del *Traité des Matériaux*, eds Presses Polytechniques et Universitaires Romandes (1993)
- [Las03] Liao H., Andersson A.S., Sutherland D., Petronis S., Kasemo B., Thomsen P. "Response of rat osteoblast-like cells to microstructured model surfaces *in vitro*", *Biomaterials*, 24:649-654 (2003)
- [Lbs89] Lewandowska K., Balachander N., Sukenik C.N., Culp L.A. "Modulation of Fibronectin Adhesive Functions for Fibroblasts and Neural Cells by Chemically Derivatized Substrata", *Journal of Cellular Physiology*, 141:334-345 (1989)
- [Lbs00] Lohmann C.H., Bonewald L.F., Sisk M.A., Sylvia V.L., Cochran D.L., Dean D.D., Boyan B.D., Schwartz Z. "Maturation state determines the response of osteogenic cells to surface roughness and 1,25-dihydroxyvitamin D<sub>3</sub>", *Journal of Bone and Mineral Research*, 15:1169-1180 (2000)
- [Lbs00b] Lu G., Bernasek S.L., Schwartz J. "Oxidation of a polycrystalline titanium surface by oxygen and water", *Surface Science*, 458:80-90 (2000)
- [Lkl03] Lee B.-H., Kim Y.D., Lee K.H. "XPS study of bioactive graded layer in Ti-In-Nb-Ta alloy prepared by alkali and heat treatment", *Biomaterials*, 24:2257-2266 (2003)
- [Lib02] Lange R., Luthen F., Beck U., Rychly J., Baumann A., Nebe B. "Cell-extracellular matrix interaction and physico-chemical characteristics of titanium surfaces depend on the roughness of the material", *Biomolecular Engineering*, 19:255-61 (2002)

- [**Llk97**] Lee J.H., Lee J.W., Khang G., Lee H.B. "Interaction of cells on chargeable functional group gradient surfaces", *Biomaterials*, 18:351-358 (1997)
- [**Los01**] Lim Y.J., Oshida Y. "Initial contact angle measurements on variously treated dental/medical titanium materials", *Bio-Medical Materials and Engineering*, 11:325-341 (2001)
- [**Lsa97**] Lucassen M., Sarcar B., "Ni binding constituents of human blood serum", *Journal of Toxicology and Environmental Health*, 5:897-905 (1997)
- [**Lsu95**] Liu S.M., Sundqvist T. "Effects of hydrogen-peroxide and phorbol-myristate acetate on endothelial transport and f-actin distribution", *Experimental Cell Research* 217: 1-7 (1995)
- [**Lsy04**] Liu J.X., Shi F., Yang D.Z. "Characterization of sol-gel-derived TiO<sub>2</sub> and TiO<sub>2</sub>-SiO<sub>2</sub> films for biomedical applications", *Journal of Materials Science & Technology* 20:550-554 (2004)
- [**Lta96**] Larsson C., Thomsen P., Aronsson B.-O, Rodahl M., Lausmaa J., Kasemo B., Ericson L.E.. "Bone response to surface-modified titanium implants: studies on the early tissue response machined and electropolished implants with different oxides thicknesses", *Biomaterials*, 17:605-616 (1996)
- [**Lum86**] Lumsden J.B. X-Ray Photoelectron Spectroscopy, en *ASM Handbook*, vol. 10: Materials Characterization, ASM, pp 568-580 (1986)
- [**Lwl97**] Lampin M., Warocquier-Clerout R., Legris C., Degrange M., Sigot-Luizard M.F. "Correlation between substratum roughness and wettability, cell adhesion, and cell migration", *Journal of Biomedical Materials Research*, 36:99-108 (1997)
- [**Mac58**] MacFarlane A.S., "Efficient trace-labelling of proteins with iodine", *Nature*, 182:53 (1958)
- [**Mcf04**] Mc Fayden P. "Zeta potential of macroscopic surfaces from streaming potential measurements", from Brookhaven Instruments Corporation website: [www.bic.com/PDFs/ZetaPotentialofMacroscopicSurfaces.pdf](http://www.bic.com/PDFs/ZetaPotentialofMacroscopicSurfaces.pdf) (2004)
- [**Mch04**] Melissano G., Chiesa R. "Regarding "Disappointing results with a new commercially available thoracic endograft" - Reply", *Journal of Vascular Surgery*, 40:207-208 (2004)
- [**Mdm02**] MacDonald D.E., Deo N., Markovic B., Stranick M., Somasundaran P. "Adsorption and dissolution behavior of human plasma fibronectin on thermally and chemically modified titanium dioxide particles", *Biomaterials*, 23:1269-1279 (2002)
- [**Mgr05**] Mändl S., Gerlach J.W., Rauschenbach B. "Surface modification of NiTi for orthopaedic braces by plasma immersion ion implantation", *Surface and Coatings Technology*, 196 (1-3):293-297 (2005)
- [**Mgw93**] Meyle J., Gultig K., Wolburg H., Vonrecum A.F. "Fibroblast anchorage to microtextured surfaces", *Journal of Biomedical Materials Research*, 27:1553-1557 (1993)
- [**Mlu02**] Messer R.L.W., Lucas L.C. "Localization of metallic ions within gingival fibroblast subcellular fractions", *Journal of Biomedical Materials Research*, 59:466-472 (2002)

- [**Moc97**] Morra M., Cassinelli C. "Bacterial adhesion to polymer surfaces: a critical review of surface thermodynamic approaches", *Journal of Biomaterials Science-Polymer Edition*, 9:55-74 (1997)
- [**Mrd04**] MacDonald D.E., Rapuano B.E., Deo N., Stranick M., Somasundaran P., Boskey A.L. "Thermal and chemical modification of titanium-aluminum-vanadium implant materials: effects on surface properties, glycoprotein adsorption, and MG63 cell attachment", *Biomaterials*, 25:3135-3146 (2004)
- [**Mss92**] Moulder J.F., Stickle W.F., Sobol P.E., Bomben K. "Handbook of X-Ray Photoelectron Spectroscopy", Chastain J. ed., Perkin-Elmer Corporation (Physical Electronics), 2<sup>nd</sup> edition (1992)
- [**Mss96**] Marque D., Souberbielle J.C., Sachs C. "L'ostéocalcine", *Immunoanalyse et Biologie Spécialisée*, 11:115-118 (1996)
- [**Mtc04**] Melissano G., Tshomba Y., Civilini E., Chiesa R. "Disappointing results with a new commercially available thoracic endograft", *Journal of Vascular Surgery*, 39:124-130 (2004)
- [**Mtd00**] McFarland C.D., Thomas C.H., DeFilippis C., Steele J.G., Healy K.E.. "Protein adsorption and cell attachment to patterned surfaces", *Journal of Biomedical Materials Research*, 49:200-210 (2000)
- [**Mwi99**] McCafferty E., Wightman J.P. "An X-Ray photoelectron spectroscopy sputter profile study of the native air-formed film on titanium", *Applied Surface Science*, 143:92-100 (1999)
- [**Mwl05**] Messer R.L.W., Wataha J.C., Lewis J.B., Lockwood P.E., Caughman G.B., Tseng W.Y. "Effect of vascular stent alloys on expression of cellular adhesion molecules by endothelial cells", *Journal of Long Term Effect of Medical Implants*, 15:39-47 (2005)
- [**Ngj00**] Norde W., Giacomelli C.E. "BSA structural changes during homomolecular exchange between the adsorbed and the dissolved states", *Journal of Biotechnology*, 79:259-268 (2000)
- [**Nka03**] zur Nieden N.I., Kempka G., Ahr H.J. "In vitro differentiation of embryonic stem cells into mineralized osteoblasts", *Differentiation*, 71:18-27 (2003)
- [**Nmg75**] Nielson F.H., Myron D.R., Givand S.H, Zimmermann T.J., Ollerich D.A. "Nickel deficiency in rats", *Journal of Nutrition*, 105:1620-1630 (1975)
- [**Nsm84**] Nielson F.H., Shuler T.R., McLeod T.G., Zimmermann T.J. "Nickel influences iron metabolism through physiologic, pharmacologic and toxicologic mechanisms in the rat", *Journal of Nutrition*, 114:1280-1288 (1984)
- [**Oih97**] Ohtsuki C., Iida H., Hayakawa S., Osaka A. "Bioactivity of Ti treated with hydrogen peroxide solutions containing metal chlorides", *Journal of Biomedical Materials Research*, 35:39-47 (1997)

- [Oms89] Oreffo R.O.C., Mundy G.R., Seyedin S.M., Bonewald L.F. "Activation of the Bone-Derived Latent TGF-Beta-Complex by Isolated Osteoclasts", *Biochemical and Biophysical Research Communications*, 158:817-823 (1989)
- [Par65] Parks G. "The isoelectric points of solid oxides, solid hydroxides, and aqueous hydroxo complex systems", *Chemical Reviews*, 65:177-198 (1965)
- [Par92] Park J.B., Lakes R.S. *Biomaterials, An introduction*. 2<sup>nd</sup> edition, Plenum Press, New-York (1992)
- [Pdx93] Patierno S.R., Dirscherl L.A., Xu J. "Transformation of Rat Tracheal Epithelial-Cells to Immortal Growth Variants by Particulate and Soluble Nickel Compounds", *Mutation Research*, 300:179-193 (1993)
- [Pel79] Peltonen L. "Nickel sensitivity in general population", *Contact Dermatitis*, 5:27-32 (1979)
- [Pgl05] Plant S.D., Grant D.M., Leach L. "Behaviour of human endothelial cells on surface modified NiTi alloy", *Biomaterials*, 26:5359-5367 (2005)
- [Pgp97] Proubasta I., Gil J., Planell J.A. *Fundamentos de Biomecánica y Biomateriales*, ed Ergon S.A., Madrid (1997)
- [Phl05] Poon R.W.Y., Ho J.P.Y., Liu X.Y., Chung C.Y., Chu P.K., Yeung K.W.K., Lu W.W., Cheung K.M.C. "Anti-corrosion performance of oxidized and oxygen plasma-implanted NiTi alloys", *Materials Science and Engineering A-Structural Materials Properties Microstructure and Processing*, 390:444-451 (2005)
- [Pkb88] Pearson B.S., Klebe R.J., Boyan B.D., Moskowicz D. "Comments on the clinical application of fibronectin in dentistry", *Journal of Dental Research*, 67:515-517 (1988)
- [Plc05] Poon, R.W.Y., Liu X.Y., Chung C.Y., Chu R.K., Yeung K.W.K., Lu W.W., Cheung K.M.C. "Surface and corrosion characteristics of carbon plasma implanted and deposited nickel-titanium alloy", *Journal of Vacuum Science and Technology*, A23 (3):525-530 (2005)
- [Pmm02] Pelletier H., Muller D., Mille P., Grob J.J. "Effect of high energy argon implantation into NiTi shape memory alloy", *Surface and Coatings Technology*, 158:301-308 (2002)
- [Poj03] Pourahmad M., O'Brien P.J., Jokar F., Daraei B. "Carcinogenic metal induced sites of reactive oxygen species formation in hepatocytes", *Toxicology in Vitro*, 17:803-810 (2003)
- [Prj03] Ponsonnet L., Reybier K., Jaffrezic N., Comte V., Lagneau C., Lissac M., Martelet C. "Relationship between surface properties (roughness, wettability) of titanium and titanium alloys and cell behaviour", *Materials Science and Engineering C*, 23:551-560 (2003)
- [Psm05] Peña J., Solano E., Mendoza A., Casals J., Planell J.A., Gil F.J. "Effect of the Ms transformation temperature on the wear behaviour of NiTi shape memory alloys for articular prosthesis", *Bio-Medical Materials and Engineering* 15:289-293 (2005)

- [Ptl96] Pan J., Thierry D., Leygraf C. "Electrochemical impedance spectroscopy study of the passive oxide film on titanium for implant application". *Electrochimica Acta*, 41:1143-1153 (1996)
- [Pyl05] Poon R.W.Y., Yeung K.W.K., Liu X.Y., Chu P.K., Chung C.Y., Lu W.W., Cheung K.M.C., Chan D. "Carbon plasma immersion ion implantation of nickel-titanium shape memory alloys", *Biomaterials*, 26:2265-2272 (2005)
- [Pzt90] Pankowsky D.A., Ziats N.P., Topham N.S., Ratnoff O.D., Anderson J.M.. "Morphologic characteristics of adsorbed human plasma proteins on vascular grafts and biomaterials", *Journal of Vascular Surgery*, 11:599-606 (1990)
- [Qsk98] Qiu,Q., Sayer M., Kawaja M., Shen X., Davies J.E. "Attachment, morphology, and protein expression of rat marrow stromal cells cultured on charged substrate surfaces", *Journal of Biomedical Materials Research*, 42(1):117-127 (1998)
- [Rap89] Rapoza J.R., "Mechanisms of protein adsorption: multiple adsorption status", Tesis Doctoral, University of Washington, USA (1989)
- [Reh04] Rocher P., El Medawar L., Hornez J.C., Traisnel M., Breme J., Hildebrand H.F. "Biocorrosion and cytocompatibility assessment of NiTi shape memory alloys", *Scripta Materialia*, 50:255-260 (2004)
- [Rho90] Rapoza R. J., Horbett T.A. "Postadsorptive Transitions in Fibrinogen - Influence of Polymer Properties", *Journal of Biomedical Materials Research*, 24:1263-1287 (1990)
- [Rho90b] Rapoza R.J., Horbett T.A. "The Effects of Concentration and Adsorption Time on the Elutability of Adsorbed Proteins in Surfactant Solutions of Varying Structures and Concentrations", *Journal of Colloid and Interface Science*, 136:480-493 (1990)
- [Rhs04] Ratner B.D., Hoffman A.S., Schoen F.J. *Biomaterials Science. An introduction to materials in medicine*, 2<sup>nd</sup> edition, Elsevier Academic Press (2004)
- [Rhs04b] Ratner B.D., Hoffman A.S., Schoen F.J. "Surface Properties and Surface Characterization of Materials", en *Biomaterials Science. An introduction to materials in medicine*, 2<sup>nd</sup> edition, Elsevier Academic Press, p 40 (2004)
- [Rlf98] Rechavia E., Litvack F., Fishbien M.C, Nakamura M., Eigler N. "Biocompatibility of polyurethane-coated stents: tissue and vascular aspects", *Catheterization and Cardiovascular Diagnosis*, 45:202-207 (1998)
- [Rmg05] Rezwani K., Meier L.P., Gauckler L.J. "Lysozyme and bovine serum albumin adsorption on uncoated silica and ALOOH-coated silica particles: the influence of positively and negatively charged oxide surfaces coatings", *Biomaterials*, 26:4351-4357 (2005)
- [Rns97] Ryhänen J, Niemi E., Serlo W., Niemelä E., Sandvik P., Pernu H., Salo T. "Biocompatibility of Nickel-titanium shape memory metal and its corrosion behavior in human cell cultures", *Journal of Biomedical Materials Research*, 35:451-457 (1997)

- [Rod00] Rodriguez D. "Obtención de capas de nitruro de titanio mediante tratamiento termoquímico en titanio y Ti6Al4V, y caracterización de sus propiedades para aplicaciones biomédicas", Tesis Doctoral, Universidad Politècnica de Catalunya, Barcelona (2000)
- [Ron96] Rondelli G. "Corrosion resistance tests on NiTi Shape memory alloys". *Biomaterials*, 17:2003-2008 (1996)
- [Rvi00] Rondelli G., Vicentini B. "Evaluation by electrochemical tests of the passive film stability of equiatomic NiTi alloy also in presence of stress-induced martensite". *Journal of Biomedical Materials Research*, 51:47-54 (2000)
- [Ryh99] Ryhänen J. "Biocompatibility evaluation of nickel-titanium shape memory metal alloy", Tesis Doctoral, Universidad de Oulu, Finlandia (1999)
- [Rzs02] Roessler S., Zimmermann R., Scharnweber D., Werner C., Worch H. "Characterization of oxide layers on Ti6Al4V and titanium by streaming potential and streaming current measurements", *Colloids and Surfaces B: Biointerfaces*, 26:387-395 (2002)
- [Sak01] Sehitoglu H., Anderson R., Karaman I., Gall K., Chumlyakov Y. "Cyclic deformation behavior of single crystal NiTi", *Materials Science and Engineering A-Structural Materials Properties Microstructure and Processing*, 314:67-74 (2001)
- [San95] Shabalovskaya S.A., Anderegg J.W. "Surface spectroscopic characterization of TiNi nearly equiatomic shape memory alloys for implants", *Journal of Vacuum Science Technology A*, 13:2624-2632 (1995)
- [Sbg02] Stephansson S.N., Byers B.A., Garcia A.J. "Enhanced expression of the osteoblastic phenotype on substrates that modulate fibronectin conformation and integrin receptor binding", *Biomaterials*, 23:2527-2534 (2002)
- [Sbo88] Schwartz, Z., Boyan, B. "The Effects of Vitamin-D Metabolites on Phospholipase-A2 Activity of Growth Zone and Resting Zone Cartilage Cells-Invitro", *Endocrinology*, 122:2191-2198 (1988)
- [Sbu94] Schneider G., Burrige K. "Formation of Focal Adhesions by Osteoblasts Adhering to Different Substrata", *Experimental Cell Research*, 214:264-269 (1994)
- [Sbw05] Siebers M.C., ter Brugge P.J., Walboomers X.F., Jansen J.A. "Integrins as linker proteins between osteoblasts and bone replacing materials. A critical review", *Biomaterials*, 26:137-146 (2005)
- [Sca04] Schuster G. S., Caughman G. B. "Alterations of cell lipids by metal salts", *Journal of Biomedical Materials Research Part A*, 70A:347-353 (2004)
- [Sdj93] Steele J.G., Dalton B.A., Johnson G., Underwood P.A. "Polystyrene chemistry affects vitronectin activity : an explanation for cell attachment to tissue culture polystyrene but not to unmodified polystyrene". *Journal of Biomedical Materials Research*, 27:927-X (1993)

- [Seg02] Seibel J.M., Eastell R, Gundberg C.M., Hannon R., Pols H.A.P. "Biochemical markers of bone metabolism", Capítulo 90 en Principles of Bone Biology, Volumen 2, Second Edition, Bilezikian J.P., Raisz L.G., Rodan G.A., eds., Academic Press (2002)
- [Sgc02] Scotchford C.A., Gilmore C.P., Cooper E., Leggett G.J., Downes S. "Protein adsorption and human osteoblast-like cell attachment and growth on alkylthiol on gold self-assembled monolayers". Journal of Biomedical Materials Research, 59:84-99 (2002)
- [Sgo01] Starosvetsky D., Gotman I. "Corrosion behavior of titanium nitride coated NiTi shape memory surgical alloy", Biomaterials, 22:1853-9 (2001)
- [Sha95] Shabalovskaya S. "Biological aspects of TiNi alloy surfaces", Journal de physique IV, 5:1199-1204 (1995)
- [Sha96] Shabalovskaya S.A. "On the nature of biocompatibility and on medical applications of NiTi shape memory and superelastic alloys", Bio-Medical Materials and Engineering, 6:267-289 (1996)
- [Sha01] Shabalovskaya S.A. "Physicochemical and biological aspects of Nitinol as a biomaterial", International Materials Review, 46:233-250 (2001)
- [Sha02] Shabalovskaya S. "Surface, corrosion and biocompatibility aspects of Nitinol as an implant material", Bio-Medical Materials Engineering, 12:69-109 (2002)
- [Shi95] Shirkhazadeh M. "XRD and XPS characterization of superelastic TiO<sub>2</sub> coatings prepared on Ti6Al4V surgical alloy by an electrochemical method", Journal of Materials Science: materials in medicine, 6:206-210 (1995)
- [Sho89] Slack S.M., Horbett T.A. "Changes in the Strength of Fibrinogen Attachment to Solid-Surfaces - An Explanation of the Influence of Surface-Chemistry on the Vroman Effect", Journal of Colloid and Interface Science, 133:148-165 (1989)
- [Shs86] Spears J.W., Harvey R.W., Samsell L.J. "Effects of dietary nickel and protein on growth, nitrogen metabolism and tissue concentrations of nickel, iron, zinc, manganese, and copper in calves", Journal of Nutrition, 116:1873-1882 (1986)
- [Shw04] Shabalovskaya S., Hauch K., Wataha J., Anderegg J., Poncet P., Cunnick J. "Effects of surface chemistry on biocompatibility of NiTi", Conference proceeding, International conference on shape memory and superelastic technologies, Baden-Baden, Germany (October 2004)
- [Ski96] Stang G.I., Kirchgessner M. "Nickel deficiency alters liver lipid metabolism in rats", Journal of Nutrition, 126:2466-2473 (1996)
- [Sic01] Sisk M.A., Lohmann C.H., Cochran D.L., Sylvia V.L., Simpson J.P, Dean D.D., Boyan B.D., Schwartz Z. "Inhibition of cyclooxygenase by indomethacin modulates osteoblast response to titanium surface roughness in a time-dependent manner", Clinical Oral Implants Research, 12:52-61 (2001)



- [**Smd93**] Steele J.G., Mcfarland C., Dalton B.A., Johnson G., Evans M.D.M., Howlett C.R., Underwood P.A. "Attachment of Human Bone-Cells to Tissue-Culture Polystyrene and to Unmodified Polystyrene - the Effect of Surface-Chemistry Upon Initial Cell Attachment", *Journal of Biomaterials Science-Polymer Edition*, 5:245-257 (1993)
- [**Smd96**] Schwartz Z., Martin J.Y., Dean D.D., Simpson J., Cochran D.L., Boyan B.D. "Effect of titanium surface roughness on chondrocyte proliferation, matrix production, and differentiation depends on the state of cell maturation", *Journal of Biomedical Materials Research*, 30:145-155 (1996)
- [**Sms04**] Sousa S.R., Moradas-Ferreira P., Saramago B., Melo L.V., Barbosa M.A. "Human serum albumin adsorption on TiO<sub>2</sub> from single protein solutions and from plasma", *Langmuir*, 20:9745-54 (2004)
- [**Sos96**] Shibuichi S., Onda T., Satoh N., Tsujii K. "Super water-repellent surfaces resulting from fractal structure", *Journal of Physical Chemistry*, 100:19512-19517 (1996)
- [**Spk79**] Solar R.J., Pollack S.R., Korostoff E. "*In vitro* corrosion testing of titanium surgical implant alloys: an approach to understanding titanium release from implants". *Journal of Biomedical Materials Research*, 13:217-250 (1979)
- [**Spm04**] Shevchenko N., Pham M.T., Maitz M.F. "Studies of surface modified NiTi alloy", *Applied Surface Science*, 235:126-31 (2004)
- [**Sra03**] Shabalovskaya S., Rondelli G., Anderegg J., Simpson B., Budko S. "Effect of chemical etching and aging in boiling water on the corrosion resistance of nitinol wires with black oxide resulting from manufacturing process", *Journal of Biomedical Materials Research (Applied Biomaterials)*, 66B:331-340 (2003)
- [**Srd98**] Shelton R.M., Rasmussen A.C., Davies J.E. "Protein adsorption at the interface between charged polymer substrata and migrating osteoblasts", *Biomaterials*, 9(1):24-29 (1998)
- [**Sru91**] Savage B., Ruggeri Z.M. "Selective Recognition of Adhesive Sites in Surface-Bound Fibrinogen by Glycoprotein IIb-IIa on Nonactivated Platelets", *Journal of Biological Chemistry*, 266:11227-11233 (1991)
- [**Stu96**] Sinha R.K., Tuan R.S. "Regulation of human osteoblast integrin expression by orthopedic implant materials", *Bone*, 18:451-7 (1996)
- [**Svb97**] Schurmann K., Vorwerk D., Bucker A., Neuerburg J., Klosterhalfen B., Muller G., Uppenkamp R., Gunther R.W. "Perigraft inflammation due to Dacron-covered stent-grafts in sheep iliac arteries: correlation of MR imaging and histopathologic findings", *Radiology*, 204:757-763 (2005)
- [**Swh97**] Sun ZL, Wataha J.C., Hanks C.T. "Effects of metal ion on osteoblast-like cell metabolism and differentiation", *Journal of Biomedical Materials Research*, 34:29-37 (1997)

- [**Tas86**] Terranova V.P., Aumailley M., Sultan L.H., Martin G.R., Kleinman H.K. "Regulation of Cell Attachment and Cell Number by Fibronectin and Laminin", *Journal of Cellular Physiology*, 127:473-479 (1986)
- [**Tcg01**] Tidwell C.D., Castner D.G., Ratner B.D. "Static time-of-flight secondary ion mass spectrometry and X-ray spectroscopy characterization of adsorbed albumin and fibronectin films", *Surface and Interface Analysis*, 31:724-733 (2001)
- [**Tcr02**] Tan L., Crone W.C. "Surface characterization of NiTi modified by plasma source ion implantation", *Acta Materialia*, 50:4449-4460 (2002)
- [**Tcr05**] Tan L. and Crone W.C. "Effects of methane plasma ion implantation on the microstructure and wear resistance of NiTi shape memory alloys", *Thin Solid Films*, 472:282-290 (2005)
- [**Thi94**] Takamura K., Hayashi K., Ishinishi N., Yamada T., Sugioka Y. "Evaluation of carcinogenicity and chronic toxicity associated with orthopedic implants in mice", *Journal of Biomedical Materials Research*, 28:583-589 (1994)
- [**Thn98**] Trigwell S, Hayden R.D., Nelson K.F., Selvaduray G. "Effects of surface treatment on the surface chemistry of NiTi alloy for biomedical applications", *Surface and Interface Analysis*, 26:483-489 (1998)
- [**Tio00**] Takebe J., Itoh S., Okada J., Ishibashi K. "Anodic oxidation and hydrothermal treatment of titanium results in a surface that causes increased attachment and altered cytoskeletal morphology of rat bone marrow stromal cells in vitro", *Journal of Biomedical Materials Research*, 51:398-407 (2000)
- [**Tlt99**] Trépanier C., Leung T.K., Tabrizian M., Yahia L'H., Bienvenu J.-G., Tanguay J.-F., Piron D.L., Bilodeau L. "Preliminary Investigation of the effects of surface treatments on biological response to shape memory NiTi stents", *Journal of Biomedical Materials Research (Applied Biomaterials)*, 48:165-171 (1999)
- [**Tmb02**] Thierry B., Merhi Y., Bilodeau L., Trépanier C., Tabrizian M. "Nitinol versus stainless steel stents: acute thrombogenicity study in an ex vivo porcine model", *Biomaterials*, 23:2997-3005 (2002)
- [**Tmj97**] Thomas C.H., McFarland C.D., Jenkins M.L., Rezanian A., Steele J.G., Healy K.E. "The role of vitronectin in the attachment and spatial distribution of bone-derived cells on materials with patterned surface chemistry", *Journal of Biomedical Materials Research*, 37:81-93 (1997)
- [**Tms84**] Tietze H., Mullner M., Selgert P. "Temperature-induced precipitations in the memory alloy NiTi", *Journal of Physics D*, 17:1391-1398 (1984)
- [**Tpu95**] Thompson G. J., Puleo D. A. "Effects of Sublethal Metal-Ion Concentrations on Osteogenic Cells Derived from Bone-Marrow Stromal Cells", *Journal of Applied Biomaterials*, 6:249-258 (1995)

- [Tss05] Tan L., Shaw G., Sridharan K., Crone W.C. "Effects of oxygen ion implantation on wear behavior of NiTi shape memory alloy", *Mechanics of Materials*, 37:1059-1068 (2005)
- [Ttt00] Thierry B., Tabrizian M., Trépanier C., Savadogo O., Yahia L'H. "Effect of surface treatment and sterilization processes on the corrosion behavior of NiTi shape memory alloy", *Journal of Biomedical Materials Research*, 51:685-693 (2000)
- [Tty98] Trépanier C., Tabrizian M., Yahia L'H., Bilodeau L., Piron D.L. "Effect of modification of oxide layer on Niti stent corrosion resistance", *Journal of Biomedical Materials Research*, 43:433-440 (1998)
- [Utl87] Ustinskaya T., Tomashev N., Lubnin E. "Composition and electrical and protective properties of anodic films formed on the intermetallic compound TiNi", *Soviet Electrochemistry*, 23(2):225-231 (1987)
- [Uzv95] Ugarova T.P., Zamarron C., Veklich Y., Bowditch R. , Ginsberg M.H., Weisel J.W., Plow E.F. "Conformational Transitions in the Cell-Binding Domain of Fibronectin", *Biochemistry*, 34:4457-4466 (1995)
- [Vmc05] Valko M., Morris H., Cronin M.T.D. "Metals, toxicity and oxidative stress", *Current Medicinal Chemistry*, 12:1161-1208 (2005)
- [Vof05] Vaidya S.S., Ofoli R.Y. "Adsorption and interaction of fibronectin and human serum albumin at the liquid-liquid interface", *Langmuir*, 21:5852-5858 (2005)
- [Vog98] Vogler E.A. "Structure and reactivity of water at biomaterial surfaces", *Advances in Colloid and Interface Science*, 74:69-117 (1998)
- [Wbd91] Williams D.F., Black J., Doherty P.J., Second Consensus Conference, Definitions in Biomaterials, Chester, England (1991); en Biomaterial-Tissue Interfaces. *Advances in Biomaterials*, Vol. 10, Doherty P.J., Williams R.L., Williams D.F., Lee A.J.C., eds., Elsevier, Amsterdam, p. 525 (1992)
- [Wbl04] Wozniak K., Blasiak J. "Nickel impairs the repair of UV- and MNNG-damaged DNA", *Cellular & Molecular Biology Letters*, 9:83-94 (2004)
- [Wcl05] Wilson C.J., Clegg R.E, Leavesley D.I., Percy M.J. "Mediation of biomaterial-cell interactions by adsorbed proteins: a review", *Tissue Engineering*, 11:1-18 (2005)
- [Wcl05b] Wirth C., Comte V., Lagneau C., Exbrayat P., Lissac M., Jaffrezic-Renault N., Ponsonnet L. "Nitinol surface roughness modulates in vitro cell response: a comparison between fibroblasts and osteoblasts", *Materials Science and Engineering C*, 25:51-60 (2005)
- [Whc93] Wataha J.C., Hanks C.T., Craig R.G. "Uptake of metal cations by fibroblasts in vitro", *Journal of Biomedical Materials Research*, 27:227-232 (1993)
- [Wht98] Webb K., Hlady V., and Tresco P.A. "Relative importance of surface wettability and charged functional groups on NIH3T3 fibroblast attachment, spreading, and cytoskeletal organization", *Journal of Biomedical Materials Research*, 41:422-430 (1998)

- [Wht00] Webb K., Hlady V., Tresco P.A. "Relationships among cell attachment, spreading, cytoskeletal organization, and migration rate for anchorage-dependent cells on model surfaces", *Journal of Biomedical Materials Research*, 49:362-368 (2000)
- [Wis00] D.L. Wise, *Biomaterials and Bioengineering Handbook*, Marcel Dekker, New-York (2000)
- [Wlm99] Wataha J.C., Lockwood P. E., Marek M., Ghazi M. "Ability of Ni-containing biomedical alloys to activate monocytes and endothelial cells *in vitro*", *Journal of Biomedical Materials Research*, 45:251-257 (1999)
- [Wos01] Wataha J.C., O'Dell N.L., Singh B.B, Ghazi M., Whitford G.M., Lockwood P.E. "Relating Nickel-Induced Tissue Inflammation to Nickel Release *in vivo*", *Journal of Biomedical Materials Research*, 58:537-544 (2001)
- [Wrh96] Wataha J.C., Ratanasathienz S., Hank C.T., Sun Z. "*In vitro* Il1-beta and TNF-alfa release from THP-1 monocytes in response to metal ions", *Dental Materials*, 12:322-327 (1996)
- [Wvs97] Wever D.J., Veldhuizen A.G., Sanders M.M., Schakenraad J.M., van Horn J.R. "Cytotoxic, allergic and genotoxic activity of a nickel-titanium alloy", *Biomaterials*, 18:1115-1120 (1997)
- [Wvv98] Wever D.J., Veldhuizen A.G., de Vries J., Busscher H.J., Uges D.R.A., van Horn J.R. "Electrochemical and surface characterization of a NiTi alloy", *Biomaterials*, 19:761-769 (1998)
- [Ypl05] Yeung K.W.K., Poon R.W.Y., Liu X.Y., Ho J.P.Y., Chung C.Y., Chu P.K., Lu W.W., Chan D., Cheung K.M.C. "Investigation of nickel suppression and cytocompatibility of surface-treated nickel-titanium shape memory alloys by using plasma immersion ion implantation", *Journal of Biomedical Materials Research*, 72:238-245 (2005)
- [Ysb02] Yang, J., Shi G.X., Bei J.Z., Wang S.G., Cao Y.L., Shang Q.X., Yang G.G., Wang W.J. "Fabrication and surface modification of macroporous poly(L-lactic acid) and poly(L-lactic-co-glycolic acid) (70/30) cell scaffolds for human skin fibroblast cell culture", *Journal of Biomedical Materials Research*, 62:438-446 (2002)
- [Zhd01] Zhao H., van Humbeeck J., De Scheerder I. "Surface conditioning of nickel-titanium alloy stents for improving biocompatibility", *Surface Engineering*, 17:451-458 (2001)
- [Zya93] Zaroogian G., Yevich P., Anderson S. "Effect of Selected Inhibitors on Cadmium, Nickel, and Benzo(A)Pyrene Uptake Into Brown Cells of *Mercenaria-Mercenaria*", *Marine Environmental Research*, 35:41-5 (1993)
- [Zzs05] Zinger O., Zhao G., Schwartz Z., Simpson J., Wieland M., Landolt D., Boyan B. "Differential regulation of osteoblasts by substrate microstructural features", *Biomaterials*, 26:1837-47 (2005)