Metallic Biomaterials (Metals)

1. Staffs and Students (April, 2009)

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2. Purpose of Education

Metallic biomaterials play an important roll as medical devices. Our laboratory mainly deals with effects of crystal structure, process, and thermal treatment on mechanical properties (e.g. strength or toughness). We also focus on structure and property of nanometer-scaled surface phenomena: Formation of living tissue on metals, especially, reactions between biomolecules or cells and metals, changes in surface oxide layers in living tissues, and electrochemical property of metallic biomaterials. The aim of the education is perfect understanding of metallic biomaterials, enabling students to select a proper material for medical treatments or researches.

3. Research Subjects

A) Bio-functionilization of metals with surface modification

Bio-functionalization on metals is investigated with surface treatment techniques, such as bio-functional molecule immobilization and electrochemical treatments.

B) Development of novel alloys for biomedical applications

Novel alloy systems for biomedical applications are explored from the viewpoint of mechanical properties and biocompatibility.

C) Development of porous metals composites with mechanical compatibility

Porous metal based composites having low Young's modulus with sustained release of inorganic ion are fabricated.

D) Development of Zr-based alloys for minimizing MRI artifacts

Zr-based alloys with high strength are investigated for the suppression of MRI artifact.

4. Publications

Original Articles

1. Tanaka Y, Saito H, Tsutsumi Y, Doi H, Nomura N, Imai H, Hanawa H. Effect of pH on the interaction between zwitterion and titanium oxide. J Colloid Interface Sci. 330: 138-143, 2009.
2. Oya K, Tanaka Y, Saito H, Kurashima K, Nogi K, Tsutsumi H, Tsutsumi Y, Doi H, Nomura N, Hanawa T. Calcification by MC3T3-E1 cells on RGD peptide immobilized on titanium through electrodeposited PEG. Biomaterials. 30: 1281-1286, 2009.
3. Tsutsumi Y, Nishimura D, Doi H, Nomura N, Hanawa T. Difference in surface reactions between titanium and zirconium in Hanks' solution to elucidate mechanism of calcium phosphate formation on titanium using XPS and cathodic polarization. Mat Sci Eng C. C29: 1702-1708, 2009.
4. Nomura N, Tanaka Y, Suyalatu, Kondo R, Doi H, Tsutsumi Y, Hanawa T. Effects of phase constitution of Zr-Nb alloys on their magnetic susceptibilities. Mater Trans. 50: 2466-2472, 2009.
5. Eliaz N, Kopelovitch W, Burstein L, Kobayashi E, Hanawa T. Electrochemical processes of nucleation and growth of calcium phosphate on titanium supported by real-time quartz crystal microbalance measurements and X-ray photoelectron spectroscopy analysis. J Biomed Mater Res Part A. 89A: 270-280, 2009.
6. Park JW, Jang JH, Lee CS, Hanawa T. Osteoconductivity of hydrophilic microstructured titanium implants with phosphate ion chemistry. Acta Biomater. 5: 2311-2321, 2009.
7. Park JW, Kim HY, Kim YJ, An CH, Hanawa T. Enhanced osteoconductivity of micro-srtuctured titanium implants (XiVE S CELLplus™) by addition of surface calcium chemistry: a histomorphometric study in the rabbit femur. Clin

Oral Impl Res. 20: 684-690, 2009.
8. Yahata Y, Yoneyama T, Hayashi Y, Ebihara, Doi H, Hanawa T, Suda. Effect of heat treatment on transformation temperatures and bending properties of nickel-Titanium endodontic instruments. Int Endodont J. 42: 621-646, 2009.
9. Tanaka Y, Kurashima K, Saito H, Nagai A, Tsutsumi Y, Doi H, Nomura N, Hanawa T. In vitro short term platelet adhesion on various metals. J Artf Org. 12: 182-186, 2009.
10. Iiyama K, Doi H, Hanawa T. Effect of mold temperature on the mechanical durability of titanium casting clasp model. Dent Mater J. 28: 610-619, 2009.

Review Articles

1. Hanawa T. An overview of biofunctionalisation of metals in Japan. J Royal Soc Interface, 6: S361-S369, 2009.
2. Hanawa T, Materials for metallic stents, J Artif Organ, 12: 73-79, 2009.

Book

1. Hanawa T, Tanaka Y, Tsutsumi H. Chapter 18, Biofunctionalization of metals, Biomaterials in Asia, Tateishi T ed. World Scientific, 292-302, 2009.