Ústav chemie materiálů
vás zve na přednášku semináře „Pokročilé materiály“

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“Využití anorganických materiálů jako biokompatibilních implantátů”

(podrobnosti na další straně)

která se koná

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v pondělí 10. března 2008, 13:00 hod.

VYUŽITÍ ANORGANICKÝCH MATERIÁLŮ JAKO BIOKOMPATIBILNÍCH IMPLANTÁTŮ

BULK AND MESOCOOPIC THERMODYNAMIC STUDIES OF INORGANIC BIOCOMPATIBLE MATERIALS UTILIZABLE FOR MIMETIC BONE TISSUE SUBSTITUTION IN SPINAL AND DENTAL PRACTICE

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Merely quarter century ago it was considered inconceivable that a man-made material could bond to living tissues. Today's the bone-like apatite formation on the surface of a suitably adjusted implant composition is of a key importance during the physical and chemical processes leading to the bonds configuration between the implanted material and the newly formed bone tissue. Despite higher brittleness bio-glass-ceramics is used in a broad spectrum of pieces suitably functional when implanted inside the human body. Such utilizability is only possible due to the possibility to adjust biocompatibility on basis of its four environmental factors: (i) Appropriate adjustment of a bulk prefixed glass composition optimized upon the thermodynamic calculation of the extent of non-bridging oxygens in the glass lattice assuming polymeric character of the common matrix silicate glass [1]. The smartness of subsequent mimetic process is likely the action of silanol groups (Si-OH), which can serve as the sites for bio-compatible volume/interface formation capable to coexist within the original tissue and the implants. (j) However, the harmonization of morphological structure of matching surfaces (porosity to allow body-liquid communication, fractal self-similarity) is also inevitable. Thus a fine tuning (ij) of surface capability to support nucleation and intergrowth of osteoblasts is necessary and can be induced even on a metallic titanium by coordinated acid (Ti-H) and alkali (Ti-OH) treatment [2], which, moreover, enables utilization of mechanically stable implants. However, a further molecular manipulation such as (ji) the addition of surfactants, doping micro-additives of various organic molecules (such as bone morphogenic proteins) is oftentimes necessity to achieve easier mineralization. Rather then using proteins a biomimetic process of surface-induced mineralization is applied. It uses simple ionic functional groups on the underlying substrate by placing the implant into an aqueous solution containing soluble ionic species of the mineral coating thereby creating the driving force for desired nucleation, which is the process authored on the mesoscopic scale. Bio-glass-ceramics that activate genes offers the possibilities of repairing, or perhaps even preventing, many disease states, such as osteoporosis, in which a large fraction of women lose a substantial amount of bone mass as they age. They can be also used as a second phase in a composite that mimics the structure and properties of bone [3-7]. In future the implication of glass activation of genes it may be possible to design therapeutic treatments or food additives that will inhibit the deterioration of connective tissues with age. Further understanding bioactivity may even help in better perception of the creation of life [4].

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