Novel ceramic nanocomposites as implant materials

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There are more than 400 000 artificial hip joint operations made every year in the word and there are some 25 000 000 people who have either a partial or a total hip replacement. It has been estimated that the aged people population has increased tremendously in recent past and there will be seven times increase. Because the human body is at the same time both a very hostile and sensitive environment for foreign objects, the life span of a hip implant is limited. Whit time, the wear and risk of the implant loosening increases so that after 10 years 10-20% of the implants have to be renewed. Biomaterials used for implant should posses some important properties in order to long-term usage in the body without rejection. One of most important properties is a biocompatibility. The biomaterial is „any substance, synthetic or natural in origin, which can be used for any period of time, as a whole a part of a system which treats, augments or replaces any tissue, organ or function of the body". Biomaterials are used in different parts of the human body as artificial valves in the heart, stensts in blood vessels, replacement implant in shoulders, knees, hips and orodental structures. Materials used as different biomaterials should be made with certain properties. The materials used for orthopedic inplants should possess excellent biocompatibility, superior corrosion resistance in body environment, excellent combination of high strength and low modulus, high ductility and be without toxicity.

The materials currently used for implants include hydroxyapatite, 316L stainless steel, cobalt-cromium alloys and pure titanium or its alloys. Elements such as Ni, Cr and Co are found to be released from the stainless steel and cobalt chromium alloys due to the corrosion in the body environment. The toxic effects of metals, Ni, Co and Cr released from prosthetic implant are known. Skin related diseases such as dermatitis due to Ni toxicity have been reported and numerous animal studies have shown carcinogenicity due to the presence of Co. From this point of view, the development of novel nanocomposite biocompatible materials is needed.

The presentation will be concentrated for review of novel biogenic and nanocomposite ceramics used as implants materials.