

Bio-Ceramic Research in the Institute of Inorganic Chemistry of SAS

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Presentation is focused on the preparation of porous silicon nitride ceramics having properties similar to the human trabecular bone.

In order to have an idea about bone structure the human trabecular bone was characterized especially in terms of pore structure which is, besides the non-toxicity, the most critical factor for acceptance of the substitute in the human body. The pore network of highly porous trabecular bone is characterised by interconnected large pores of approximately 300 – 1000 μm . Similar pore structure of silicon nitride-based ceramics was attained by the replica method with polyurethane sponge as pore forming agent. The sponge was impregnated by stabilised suspension of starting powder. Porous ceramics were prepared in two ways, namely as air-sintered silicon nitride and sintered reaction-bonded silicon nitride. The materials were characterized using the same methods as for the human bone samples.

The optimisation of the samples was focused mainly on the mechanical properties which should be similar to human bone and on enhancement the bioactivity by application of the bioactive surface layer. This way prepared ceramic materials fulfilled the microstructural requirements for bioapplications. Moreover, their non-cytotoxicity was proved by measuring the yellow tetrazolium MTT proliferation assay using human fibroblast cell line. These preliminary results are promising and the prepared porous ceramics can be a potential biomaterials for bone replacement.