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Tantalum foams for orthopaedic applications

A method for obtaining Tantalum (Ta) foams through the powder metallurgy technique for trabecular bone implants has been patented and developed. Partners to further develop the system and/or to establish commercial agreements along with technical cooperation are sought.

The Challenge

One of the latest developments in orthopaedic biomaterials has been the formation of porous systems to enhancing the biological fixation of implants through deposition or invasion of them by the surrounding bone. Nowadays, in the case of Ta, porous structures are produced via vapor deposition of tantalum at 5,458 °C on a porous skeleton of vitreous carbon. This complicated and expensive process can leave significant gaps within the pore system by the carbon implosion and traces of carbon vaporized. Although it appears to have no clinical negative effects in the performance of the implant, is far from optimal.
The challenge is to produce Ta foams through a process easier and cheaper than currently available (Electron beam melting (EBM), Chemical vapour deposition (CVD)). By a powder metallurgy technique,an implant will be obtained with a high porosity, totally interconnected and with a pore diameter to allow vascular invasion and bone inward. In turn, with mechanical properties suitable for trabecular bone implants.

The Technology

The powder metallurgy (PM) technique that will be used to obtain Ta foams is the space holder method which is a fabrication process that can produce porous metal samples of greater porosity (60-80%). This method has advantages like adjustable porosity amount, pore shape and pore size distribution. The aim of this patent is to obtain open cells structures of Ta with a porosity greater than 60%, medium pore size (100-400 μm), interconnected pores and mechanical properties suitable for trabecular bone implants.

Innovative advantages

- Easy manufacture.
- High degree of porosity (60-80%), high interconnectivity between pores and with a pore diameter greater than 100 μm allowing vascular invasion and bone inward.
- With a specially roughened surface topography.
- The Young's modulus (0.5-2%GPa) is very close to that of subchondral bone, enhancing the mechanical biocompatibility.
- High surface roughness in conjunction with a low elastic modulus cause friction between the outer surface of the foam and the surrounding bone. It is approximately 1.5 times greater than the friction produced by conventional mesh systems or with titanium or cobalt-chromium spherules, achieving an excellent primary stability of the implant.

Current stage of development

Tantalum porous systems, thus created, effectively promote their integration and invasion by the surrounding bone even in a complex quantitative and qualitative deficit of bone, with a defective contact of up to 5 mm wide. Their behavior is significantly better than those obtained with porous coatings of materials such as cobalt-chrome or titanium which have much more limited osteoconduction.

Applications and Target Market

- Total hip prosthesis, knee, ankle and shoulder
- Intersomatic implants in the spine, cervical, thoracic and lumbar

Reference number
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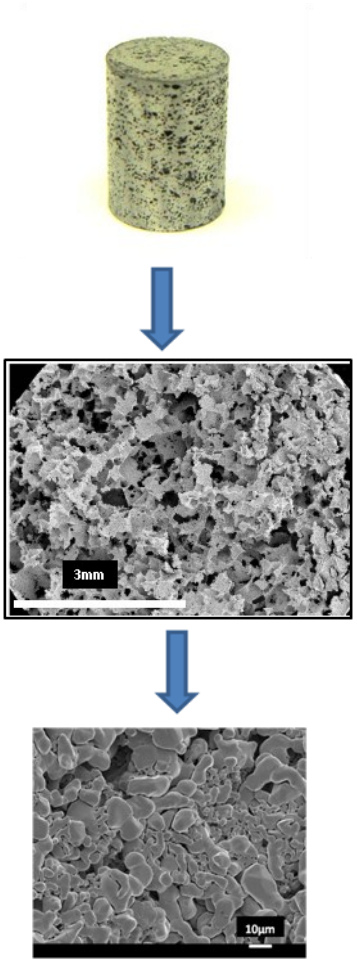
Tantalum foams



Business Opportunity
Technology available for licensing with technical cooperation

Patent Status
Priority application

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