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WTIA National Diffusion Networks
Project (NDNP) funded by the
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SUCCESS STORY NUMBER MS06: SPRAY COATINGS OF ARTIFICIAL BONE ENHANCE BIO-COMPATIBILITY – Victorian company commercialises CSIRO research outputs

Spray technology for medical implants

United Surface Technologies Pty Ltd (UST), a WTIA Corporate Member, has recently received Therapeutic Goods Authority (TGA) approval for plasma-sprayed deposition of artificial bone (Hydroxy Apatite) coatings on femoral implants.

The world-leading process was researched and developed in collaboration with the CSIRO and Australian company Portland Orthopaedics, an innovative developer, manufacturer and distributor of a range of reconstructive orthopaedic devices, predominantly joint replacement systems such as hips and knees.

UST, based in Altona Victoria, provides services to industry such as thermal spray coatings, applying metals, ceramics, carbides and plastics and the precision welded deposition of iron based, nickel based and cobalt based super alloys.

Biotechnology in Victoria

Biotechnology is regarded as one of the keys to Victoria's future prosperity with the potential to generate enormous economic, health and environmental benefits. The State Government, a supporter of the WTIA NDNP, promotes the development and commercialisation of biotechnology research as part of its goal to establish Victoria as one of the leaders in the new global 'knowledge economy'.

Biomedical applications involving materials processing technology put particular demands on technology providers. In the case of manufacturing of orthopaedic implants, exotic materials such as Co-Cr alloys and Ti-alloys are required to be cast, forged, machined, consolidated using Hot Isostatic Pressing (HIP) and surface treated.

Projects such as the WTIA's Medical Devices and Sensors Industry Sectoral Project help firms meet these demands with access to new technologies through the OzWeld Technology Support Centres Network.

Surfacing for bio-compatibility

Thermal spray coating of selected areas of medical devices with artificial bone, Hydroxy Apatite (HA), a crystalline structure that consists primarily of calcium and phosphorous

and is the major inorganic mineral found in the human body, is being carried out by UST to enhance the bio-compatibility of the surfaces of implants in the human body.

Surface preparation prior to thermal spray coating is essential to ensure good adhesion of the ceramic coating on the metal substrate. UST typically use brown or white alumina grit in a dedicated grit blasting facility, to avoid cross-contamination with residues of other materials. The grit, with an average size of 0.35 mm, is fed through a 9 mm diameter nozzle, with clean and dry compressed air at a pressure of 750 kPa as the carrier gas. With a stand-off distance of about 150 mm, the optimum surface texture is developed in a blasting time of about 30 seconds.

Some of the most important variables in successful plasma spraying of HA are the powder characteristics, including:

- Particle size and size distribution;
- Particle shape (faceted or rounded);
- Particle structure.

The chemical composition of HA spray powders is specified in ASTM F 1185-88.

Although plasma spraying of HA onto metal prostheses, and particularly onto hip joints, has been done for many years in Europe, details of the spraying conditions are rarely made available.

UST have done extensive trials in conjunction with its partners to gain the know-how and experience in plasma spray application of HA on medical implants.



*Portland HA coated stem by UST
– insert magnification of the
coating developed by CSIRO*