Workshop »Coatings for Biomedical Applications«

Thermal spray coatings on non-metallic materials for medical implants: Innovations in coating polymers and ceramics

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Plasma spraying under atmosphere (APS) or under vacuum (VPS) is used to coat implants with layers of titanium and/or hydroxyapatite (HA) in those areas that come into contact with bone to allow the bone to grow onto the implant (osseointegration). Titanium and HA both are biocompatible and widely used for implant coatings. Besides, surface chemistry and morphology play a crucial role in osseointegration. Rough and micro structured coatings with properties favourable for bone attachment can be best produced with plasma spraying. Today, such plasma coatings are state-of-the-art for medical implants.

The majority of implants are metallic and made of Ti alloys or CoCr, where for CoCr biocompatible materials are needed for clinical use. A recent innovation is the coating of ceramic implants using the VPS process. The ceramic surface cannot be grit blasted in order to avoid the risk of implant fracture. Therefore, the titanium layer is sprayed directly onto the smooth ceramic surface. Despite this, very high adhesive forces of the layer are achieved.

On the other hand, the use of polymer (PEEK) implants heavily increased mainly for spine applications. The temperature sensitivity of the PEEK implants is the main challenge for plasma coating processes. Samples of such coatings will be shown.

At the end of the lecture the focus will shift to two innovative coatings developed by Medicoat, based on wet-chemical processes. Those coatings enhance the titanium and HA layers obtained by plasma spraying and open new possibilities for functionalization.