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THE BIOCOMPATIBLE PLASMA SPRAYED COATINGS

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Abstract. This paper reveals the aspects of the research and development for the formation of biocompatible plasma spraying coatings on implants.

Various methods of biomaterial processing for the production of implants are known. In the case of applying metals and alloys as implant materials which are used with preference, their biocompatible behaviour in the human body is not satisfactory. The required mechanical properties limit the size and applicability for pure ceramic implants. One of the most modern and successful developments, combining the mechanical properties and the demanded surface properties, has been thermal spraying. Creating new coated composite materials for implants, atmospherical plasma spraying (APS) of different bioactive materials onto titanium substrates, allow a chemical bond between tissue and bioactive implant surface.

The bioactive nature and the permanence of some compact glassceramics has been known for many years. Recently, glassceramic coatings on titanium alloys have been found to combine strenght, ductility and lase of fabrication of metal, with the bioactivity and therefore bone bonding characteristics of glasserceramics. In the case of our research, the used glassceramics consists of SiO_2, CaO, MgO, CaF_2, $Ca_3(PO_4)_2$, Na_2O and K_2O.

First step in the coating production is manufacturing suitable powders by spray drying. This is one of the most critical point in thermal spraying since due to the poor flow characteristics in the powder feeding system of some bioactive spray powders, the biomaterials are agglomerated to get powder of suitable morphology and particle size distribution for the different thermal spray technologies. After the process of aglomeration, the powders are heated to stabilize their shape and mechanical strenght.

After optimization of powder production and of the spray processes, investigations are held to determine phase composition and mechanical properties of the sprayed coatings. Optical and scanning electron microscope investigation are used to document the different microstructures. Further, the determination of the mechanical properties, especially the bond strenght of the coatings is also an important point.