

Thesis Title	Plasma Spray Coating of Hydroxyapatite for Medical Applications
Thesis Credits	15
Candidate	Mr. Aekgachart Kidpanidchavisase
Supervisor	Asst. Prof. Dr. Panya Srichandr
Degree of Study	Master of Engineering
Department	Materials Technology
Academic Year	1997

Abstract

The advantages of plasma sprayed hydroxyapatite coating of medical implants are rapid adhesion of the implants onto the bone with long term biocompatibility. In addition, plasma spraying techniques are the most convenient methods to easily and rapidly produce such coatings. However, there are some inherent problems such as weak bond strength between coatings and metal substrates. Moreover, the relationship between spray parameters and the resulting structures and properties are not well understood at present. The aim of this research is to study the effect of spray parameters on the structures and mechanical properties of the coatings. The parameters of the coatings studied include the effect of hydrogen flow rate at 2, 3 and 4 ft³/hr and the powder feed rate at 25-30, 40-45 and 75-80 g/min. The influences of surface preparation techniques as well as surface roughness in the range 1.5-2.0, 4.5-5.0 and 10.0-12.0 μm were also studied together with the influences of passivation treatment and preheating of substrates.

The results showed that hydroxyapatite powder melt more easily when hydrogen flow rate was increased. This is evident from higher average hardness and

lower porosities in the coatings. At hydrogen flow rate of 3 ft³/hr, maximum thickness was achieved in the range between 300 to 600 μm . X-ray diffraction analysis showed that the phase of hydroxyapatite remained unchanged under our experimental conditions, only slight line-broadening was found. The results also showed that increasing surface roughness yielded higher bond strength. Surface preparation using alumina grit showed higher bond strength than those using steel grits at the same roughness. In this experiment, it was found that the highest bond strength of 31.4 MPa was achieved when the stainless steel surface was grit blasted using alumina to 4.5-5.0 μm . Passivation of stainless steel substrate resulted in increase in bond strength significantly from about 14.3 MPa for the non-passivated samples to about 31.4 MPa. Preheating of substrate led to lower bond strength.

Keywords : Plasma Spraying / Hydroxyapatite / Structure of Coatings / Surface Preparation / Bond Strength / Medical coating