Hydroxyapatite coating and silver nanoparticles assemblies on additively manufactured Ti6Al4V scaffolds

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Custom orthopedic and dental implants may be fabricated by additive manufacturing, for example using electron beam melting technology. This study is focused at the modification of the surface of Ti6Al4V alloy fabricated via additive manufacturing technology (EBM®) by radio frequency (RF) magnetron sputter deposition of hydroxyapatite (HA) coating and electrophoretic deposition of silver nanoparticles (AgNPs). The addition of AgNPs is suggested to provide antibacterial effect. The negatively charged AgNPs were synthesized by wet chemical reduction of silver nitrate by glucose in water solution. Thin nanocrystalline HA film was deposited by RF magnetron sputtering while the surface topography of Ti6Al4V samples remained unchanged. Silver nanoparticles were deposited over the surface of Ti6Al4V alloy from polyvinylpyrrolidone stabilized AgNPs solution. A uniform distribution of the AgNPs with a diameter of the metallic core of 100±20 nm and ζ -potential of -15 mV was observed across the surface of the scaffolds.The HA and AgNPs- coated Ti6Al4V samples were studied to determinethe surface wettability, hysteresis, and surface free energy. Hysteresis and water contact angle measurements revealed the effect of the deposited HA and AgNPs layer, namely an increased water contact angle compared to the as manufactured scaffolds. A higher surface free energy is observed for AgNPs-coated Ti6Al4V surface (70.17 mN/m)as compared to the uncoated surface (49.07 mN/m).