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Study of laser synthesis of bioactive $BaTiO_3$/Pt on bone implants for improved healing

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An important requirement of implants designed to replace or interact with bone is a low elastic modulus matching as closely as possible to that of the surrounding tissue. -Ti alloys, and especially those based on titanium (Ti) - niobium (Nb), have low elastic moduli and canbecome attractive orthopedic materials. Ti-Nb alloys exhibit not only non-toxicity, high corrosion resistance and beneficial mechanical properties, but also high biocompatibility. It is known that a bone is electrically active under mechanical loading, due to the piezoelectricity of collagen and the movement of ionic fluids within the bone structure. The addition of an electrically active component (such as BTO) to an implant material may improve healing and adaptation of the surrounding tissue. We studied ferroelectricity and bio-properties of $BaTiO_3$ layers (BTO) on Pt/fused silica substrates with the goal to use BTO ferroelectric layers to cover metal implants for better osseointegration in the future. BTO and Pt layers were prepared using KrF excimer laser ablation at substrate temperature Ts in the range from 200°C to 750°C in vacuum or in oxygen pressure of 10 Pa, 15 Pa and 20 Pa. BTO/Pt and Pt layers were well adhesive to FS substrate. BTO films of crystallite size 60 nm - 140 nm were fabricated. Ferroelectricity was confirmed using Raman scattering measurement and by electrical measurements. Results of AFM topology, XRD structure and ferroelectricity measurements of BTO/Pt/FS multilayers are presented. The adhesion, viability, growth and osteogenic differentiation of human osteoblast-like Saos-2 cells were also studied.

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