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Evaluation of 3YTZP films deposited by electrophoretic deposition on titanium and irradiated with Nd:YAG laser

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Titanium is widely used in chemical, power generation, aerospace and biomedical industries because of its good mechanical properties, corrosion resistance and good biocompatibility. However, when is used, for example, in steam turbines is necessary increase the corrosion resistance at high temperature, or when is used in dentistry, when the metallic gray color compromise the aesthetics rehab, it becomes interesting to coat the titanium with a ceramic layers, and 3YTZP (Yttria-stabilized tetragonal zirconia) is suitable for this application, because it has good mechanical properties, good resistance to thermal cycles and good biocompatibility. The electrophoretic deposition is a suitable technique to obtain theses coatings. After deposition, is necessary achieve out the sintering of coating, but the sintering temperature of zirconia is about 1500 °C, and submit metal/ceramic joint to this temperature, can bring on the degradation of metal. The solution to these problems is performing the sintering using a laser radiation. In this work it was studied the laser irradiation of zirconia ceramic coating deposited on titanium by electrophoretic deposition. Three series of irradiation tests were carried out using Nd:YAG (wavelength 1.06 µm) pulsed laser, energy of 0.5 J, pulse duration of 10 ms and rate of 10 Hz. During the tests, it was studied the influence of fluency, scanning speed and repetition of laser incidence. The repetition covered a range of 1 to 27 times. Prepared samples were characterized by optical and scanning electron microscopy, X-ray diffraction and scratch microindentation. The X-ray results showed presence of tetragonal and monoclinic phases in the irradiated coatings. The optical and SEM results showed that densification increases with the increasing of number of laser incidence repetition and the scratch results showed that the irradiated samples presented more scratch resistance than non-irradiated samples.