Corrosion evaluation of an optical fiber laser treated stainless steel for biomedical applications

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The implant manufacturing process includes marking the final devices for their identification, long-term quality control and traceability. Marking is carried out after cleaning and prior to sterilization. These marks eventually can concentrate stress leading to premature failure. The marked areas are defective regions that affect the oxide layer formed on the biomaterials used for implants favoring the onset of various corrosion forms, such as pitting, crevice or fatigue [1, 2]. This study aims to evaluate the effect of an Yb optical fiber laser marking process on the localized corrosion resistance of the austenitic stainless steel ISO 5832-1 samples. This is one of the most used materials for implants manufacturing. The electrochemical behavior of the marked areas obtained by this method was evaluated in a phosphate buffered solution (PBS) with pH of 7.4 and the results were compared with non treated samples. All tested surfaces were prepared according to the recommendations for clinical use. For localized corrosion resistance evaluation, electrochemical tests as monitoring the open circuit potential (OCP), electrochemical impedance spectroscopy (EIS), and cyclic potentiodynamic polarization measurements were performed. The results showed that the laser marks affects the protector characteristics of the biomaterial's passive film. Lower pitting resistance was associated to the laser marked areas, because of its roughness changes.

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References:

[1] Pieretti, E.F., Costa, I., *Electrochim. Acta, 114, p. 838–843 (2013).*

[2] Pieretti, E.F., Manhabosco S.M., Dick, L.F. P., Hinder, S.J., Costa, I., *Electrochim. Acta, 124, p. 150–155 (2014).*