Localized corrosion of laser marked M340 martensitic steel for biomedical applications

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Martensitic stainless steels (SS) are used to produce dental drills and other cutting tools. Besides elevated hardness, in biomedical applications corrosion resistance to body fluids and cleaning substances is expected. It has been previously shown [1] that laser marking increases pitting susceptibility of Mo-containing austenitic SS for implants in 0.14M Cl^- only if polarized anodically at potentials higher than 0.7V above the open circuit potential. In the case of surgical tools, laser marking is necessary for identification and to indicate the penetration depth of the cutting tool. In the present work, we studied the influence of laser marking on the localized corrosion of martensitic M340 (17.3wt% Cr, 1.1wt% Mo). Fig. 1 shows current maps obtained by the vibrating electrode technique (SVET) at increasing exposure times in 0.1M NaCl superposed to the "8" numeral drawing marked on M340. Laser marking not only increases the susceptibility to pitting, but also creates cathodic sites, probably due to increased conductivity of the oxide. The voltammograms (Fig.2) shows that the marked surface has a lower pitting potential and high active i-peak, absent on the blank surface and compatible with a lower Cr content of the surface due to the laser processing.

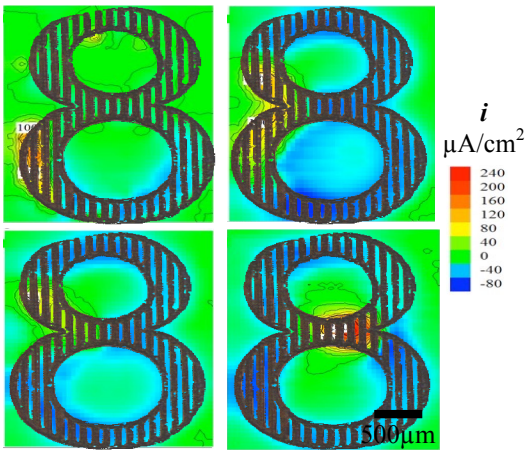

Fig.1: ***i***-maps measured at 0-15, 30-45, 60-75 and 75-90min, M340 steel in 0.1M NaCl, OCP.

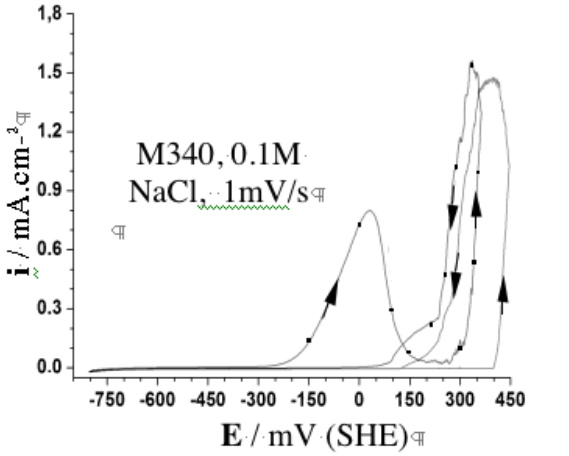

Fig. 2: Voltamogramms on M340 in 0.1M NaCl laser marked (square) and blank.

REFERENCE: 1. Pieretti, E.F., Manhabosco S.M., Dick, L.F. P., Nascente P.A. P., Hinder, S.J., Costa, I., Localized corrosion evaluation of ASTM F139 stainless steel marked by laser using SVET, XPS and Mott-Schottky techniques, *Electrochim. Acta, 124, p. 150–155 (2014).*

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