

Failure analysis of laser marked AISI M340 stainless steel for odontologic applications

Eurico F. Pieretti¹, Rogério A. Marques¹, Sara M. Manhábosco², Luís F. P. Dick², Maurício D. M. das Neves¹

¹Instituto de Pesquisas Energéticas e Nucleares (IPEN/CNEN), Av. Prof. Lineu Prestes 2242, São Paulo-SP, 05508-000, Brazil

²Laboratório de Processos Eletroquímicos e Corrosão, Universidade Federal do Rio Grande do Sul (UFRGS), Av. Bento Gonçalves, 9500, Porto Alegre- RS, 91501-970, Brazil

Abstract

The researches on biomaterials for odontologic applications implicate on corrosion investigations to provide a safety use. Surgical instruments are often produced by martensitic stainless steels (SS) because of its mechanical and electrochemical properties. Laser marking techniques are used to engrave biomaterial's surface for identification and traceability purposes. However, laser marked areas tend to be more susceptible to corrosion, which entails in early failure. The aim of this work was to evaluate the martensitic AISI M340 SS widely employed on the manufacture dental drills, in order to determine the probable causes of failure. Scanning Vibrating Electrode Technique (SVET) was used to investigate the effect of marking the surface of the AISI M340 with optical fiber laser engraving, on its localized corrosion resistance. Laser marked samples were immersed in a phosphate buffered solution (PBS) with pH 7.4 and the development of anodic and cathodic regions at the interface between the heat affected and not affected areas, by laser beam was evaluated. The results showed that the area with anodic current density was related to the laser regions and the cathodic one was generated on the adjacencies, which was also revealed by scanning electron microscopy (SEM) images.

Key-words: Biomaterials, Corrosion, Martensitic Stainless Steel, Dentistry, SVET, Laser.

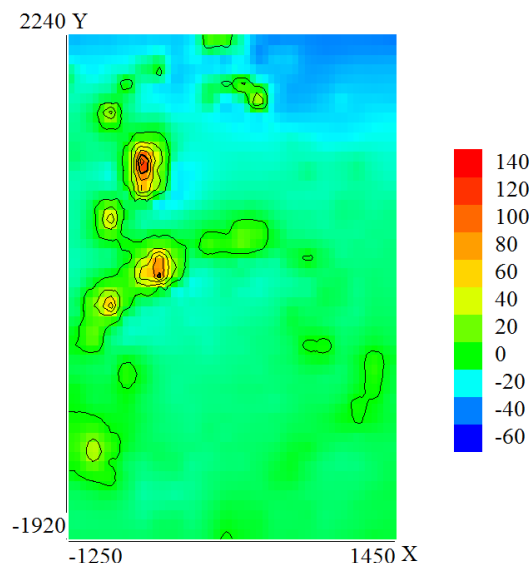


Figure1. SVET map for AISI M340 marked by laser.