Tribocorrosion properties of titanium modified by electrical discharge machining

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Resumo:
Titanium alloys are one of the most attractive metallic materials for biomedical applications for hard body tissue replacement due to their excellent mechanical properties, biocompatibility and good corrosion properties. However, they present poor wear and corrosive wear resistance, leading to undesired biological responses by the wear debris and ionic dissolution of the metal. The Electrical Discharge Machining (EDM) is a non-conventional manufacturing technique, which promote material removal by electric discharges. During the EDM process the sample surface is submitted to metallurgical modifications by the cast and recast of a thin layer over the machined surface. The aim of this work is to evaluate the influence of EDM process on the tribocorrosion properties. Ti6Al4V samples were machined in a sinking EDM machine, using finishing machining parameters. Graphite round bars with 25.4 mm of diameter and grain size of 10 µm were used as electrode and hydrocarbon fluid as dielectric solution. The surface properties were evaluated by scanning electron microscopy (SEM/EDS), and glancing angle X-ray diffraction (GA-XRD), Vickers micro hardness and tribocorrosion. The tribocorrosion was evaluated in a linear reciprocating ball on flat tribometer with a three electrode electrochemical cell coupled to potentiostat / galvanostat using a Phosphate Buffered Saline (PBS) solution. The results shows that the formation of a recast layer composed by titanium carbide (TiC) increases the hardness and the tribocorrosion resistance of titanium alloy.