Dynamical Behavior of Electrochemical Noise Associated to Corrosion Resistance of Ti-6Al-4V Alloy

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This research work presents the analysis of the dynamical behavior of electrochemical noise from Ti-6Al-4V alloy samples by reconstruction of recurrence plots (RP) and calculation of quantitative RP indexes. The aim was to evaluate the association between RP indexes and the corrosion resistance of Ti-6Al-4V. The study included electrochemical noise time series from 27 samples of Ti-6Al-4V alloy prepared under diverse conditions (milling time, sintered or green samples) and exposed to Hanks' or Ringer's solution. Voltage RP indexes were found to be different depending on the sintering method and type of exposure solution, but there were no differences among current RP indexes. Corrosion resistance were also correlated with RP indexes depending on type of sintering, solution and trend removal method. Voltage time series with polynomial trend removal had correlations with corrosion resistance only in the green samples exposed to Ringer's solution: high corrosion resistance was associated with less determinism (fewer diagonal lines but longer). In contrast, voltage time series with trend removal showed that corrosion resistance was associated with more stationary episodes (more trapping time and larger vertical lines). RP indexes may be useful to identify conditions of preparation and exposure that yield higher corrosion resistance to Ti-6Al-4V.

Keywords: Mechanical Alloying, Biomaterials, Recurrence Method, Electrochemical Noise, Corrosion.

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