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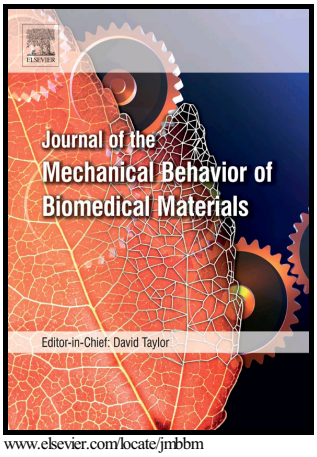

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Multi-material Ti6Al4V & PEEK cellular structures produced by Selective Laser Melting and Hot Pressing: a tribocorrosion study targeting orthopedic applications

F. Bartolomeu[1*], M. Buciumeanu[2], M. M. Costa[1], N. Alves[3], M. Gasik[4], F. S. Silva[1], G. Miranda[1]

[1]Center for Micro-Electro Mechanical Systems (CMEMS-UMinho), University of Minho, Campus de Azurém, 4800-058 Guimarães – Portugal

[2]Cross–Border Faculty of Humanities, Economics and Engineering, "Dunărea de Jos" University of Galaţi, Domnească 47, 800008 Galati, Romania

[3]Centre for Rapid and Sustainable Product Development Polytechnic Institute of Leiria, Rua General Norton de Matos, Apartado 4133, 2411-901 Leiria – Portugal

[4]Department of Materials Science and Engineering, School of Chemical Technology, Aalto University Foundation, 00076 Aalto, Espoo – Finland

*Corresponding author – F. Bartolomeu (flaviojorgebartolomeu@gmail.com)

Abstract

Ti6Al4V-alloy is commonly used in dental and orthopedic applications where tribochemical reactions occur at material/bone interface. These reactions are one of the main concerns regarding Ti6Al4V implants due to the generation of wear particles, linked to the release of metallic ions in toxic concentration which occurs when TiO_2 passive film is destroyed by means of wear and corrosion simultaneously. In the present study, a multi-material Ti6Al4V-PEEK cellular structure is proposed. Selective Laser Melting technique was used to produce Ti6Al4V dense and cellular structured specimens, whilst Hot-Pressing technique was employed to obtain multi-material Ti6Al4V-PEEK structures. This study investigates the tribocorrosion behavior of these materials under reciprocating sliding, comparing them with commercial forged Ti6Al4V. Open-circuit-potential was measured before, during and after sliding while dynamic coefficient of friction was assessed during sliding. The results showed an improved wear resistance and a lower tendency to corrosion for the multi-material Ti6Al4V-PEEK specimens when compared to dense and cellular structures mono-material specimens. This multi-material solution gathering Ti6Al4V and PEEK, besides being able to withstand the loads occurring after implantation on dental and orthopedic applications, is a promising alternative to fully dense metals once it enhances the tribocorrosion performance.

Graphical abstract