Centre for Mechanical Engineering, Materials and Processes

CEMMPRE

PROPOSTA DE PLANO DE DOUTORAMENTO/DOCTORAL PLAN PROPOSAL

(a ser redigido em Inglês / to be filled in English)

ORIENTADOR(A)/SUPERVISOR: Ana Paula da Fonseca Piedade

GRUPO/GROUP: Materials and Processes

ORIENTADOR(A)/SUPERVISOR: Ana Paula Betencourt Martins Amaro

GRUPO/GROUP: Mechanical and Intelligent Manufacturing

LOCAL DE REALIZAÇÃO DO TRABALHO/PLACE OF WORK: Department of Mechanical Engineering, University of Coimbra, Portugal

TÍTULO DO PLANO DE DOUTORAMENTO/TITLE OF THE DOCTORAL PLAN: 3D, 2D & 4D Sustainable Technologies for the production of multifunctional stents

RESUMO/SUMMARY (max. 300 words total)

Objetivo/Objectives:

The main objective is to develop invasive medical devices - stents - through completely sustainable technologies, namely: i) 3D printing of polymers to build the invasive medical device itself and ii) coating (2D material) of the stent using environmentally green technology, sputtering, with a hybrid coating (polymer/metal) in a gradient of functionality.

The choice of polymers for the manufacture of this type of medical device has the advantage that the human organism can support this class of materials with less adversity, that is, less rejection reaction, than metals. Then the medical device will be coated with a metal, specifically 316L stainless steel used in traditional bare-metal stents. This step aims to give the 3D + 2D system the reinforcement of the mechanical properties necessary for the stent to function properly and, concomitantly, to ensure that if
the rate of biodegradability of the polymeric printed stent is very high, the coating, per se, continues to ensure the clearance of the blood vessel. The entire system will be optimized so that its properties are maintained when suffering a dimensional change due to an external stimulus. In effect, the stent must also have 4D properties, so that its contraction/expansion adapts to the process of insertion into the blood vessels.

The objectives are in alignment with the Sustainable Development Goals of the United Nations, specifically Goals 3, 9, 12 and 14. Due to the inter- and multidisciplinary approach the candidate must have some experience in Materials, 3D printing, Mechanical properties and in vitro cell culture.

Resultados Esperados/Expected Results:

Development of a hybrid (polymer/metal) functional stent produced through sustainable technologies, with the appropriate mechanical, chemical and physical properties. Citocompatibility with human aorta endothelial cells is also mandatory.

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