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: Fernando António Gaspar Simões

GRUPO/GROUP: Materials and Processes

ORIENTADOR(A)/SUPERVISOR: Ivan Rodolfo Pereira Garcia de Galvão

GRUPO/GROUP: Mechanical and Intelligent Manufacturing

ORIENTADOR(A)/SUPERVISOR: Dulce Maria Esteves Rodrigues

GRUPO/GROUP: Mechanical and Intelligent Manufacturing

LOCAL DE REALIZAÇÃO DO TRABALHO/PLACE OF WORK: CEMMPRE/University of Coimbra; ISEC - Coimbra Institute of Engineering

TÍTULO DO PLANO DE DOUTORAMENTO/TITLE OF THE DOCTORAL PLAN: High-speed processing of hybrid-manufactured parts

RESUMO/SUMMARY (max. 300 words total)

Objetivo/Objectives: The increasingly demanding industrial designs require the production of metallic parts with high geometrical complexity, which can be achieved by additive manufacturing. However, the additive-manufactured parts often require post-processing by high-speed machining to improve their accuracy and surface finishing. So, hybrid-manufacturing, which regards the additive and subtractive processes as complementary technologies, enables the efficient production of complex parts with high dimensional accuracy and excellent surface finishing. The application range of hybrid manufacturing can be widened by integrating solid-state processing technologies, such as friction stir processing (FSP), in the
production of the parts. This will enable to locally change the surface properties of the parts according to the required practical applications. The success of the high-speed machining and processing operations is strongly influenced by an accurate selection of process parameters, which, in turns, requires a profound knowledge on the mechanical behaviour of the material under high temperature and high strain/strain rate conditions. This way, the aim of the present work is to study the influence of the base material plastic properties on high-speed processing of hybrid-manufactured parts.

**Resultados Esperados/Expected Results:** The mechanical characterisation of different metallic alloys under extreme conditions of temperature and strain/strain rate will be conducted. The base material characterisation results coupled with the performance of machining and FSP tests for a large range of conditions will enable to understand the thermomechanical phenomena affecting the machinability and FS processability of these materials. The study of the thermomechanical phenomena occurring during the processes will be complemented by simulation and numerical modelling, which will also provide a better understanding on the way the machining and processing conditions influence the final properties of the parts. The modelling and the analysis of the physical amounts registered during the processes will give important information aiming the automation and live control of the machining and FSP technologies.

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