

PAPER REF: 6677

SAFE-BY-DESIGN IMPLEMENTATION APPROACH IN PRODUCTION SYSTEMS - CASE STUDY, PROTECTIVE COMPOSITE COATINGS BASED IN NANO PARTICLES

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ABSTRACT

Nanotechnology focuses primarily on the characterization, manipulation, manufacture and application of materials with extremely small dimensions, in a nanoscale. The unique properties of engineered nanomaterials are an unquestionable advantage for technological applications. However, there is a need to proceed responsibly because published toxicological studies demonstrate that some nanomaterials have the potential to cause adverse human health effects [1]. In order to prevent these possible negative effects, PROCETS “PROtective composite Coatings via Electrodeposition & Thermal Spraying” project, takes advantage of the use of nano-particles and nanostructured powders for production of composite coatings, applying the Safe-by-Design to achieve coating materials with minimum risks for health of those who will be exposed to them, through the handling or use, and for the environment.

Keywords: engineered nanomaterials, nano-particles, safe-by-design.

INTRODUCTION

Wear and corrosion of materials causes losses of 3-4% of GDP (gross domestic product) in developed countries [2]. Every year, billions of Euros are spent on capital replacement and control methods for wear and corrosion infrastructure [3]. Hence, the main target of the PROCETS project is to eliminate the use of hard chromium in the European industry producing a suitable alternative in the form of innovative composite coatings as replacements to hard chromium and Co-WC coatings that presents severe environmental and health hazards. This development is based on the incorporation of nano-particles in the existing electroplating and thermal spray (TS) production techniques lines.

Consequently, there is the necessity of finding new, less hazardous methods and materials exhibiting the same or better performance compared to existing ones. The PROCETS project will take advantage of the use of nano-particles for production of composite coatings with superior properties compared to those of HC produced by electroplating or to Co-WC produced by TS. These novel nano-particles will be incorporated into existing production lines after appropriate modifications. Thus, PROCETS aims to deliver protective coatings covering a wide range of applications such as automotive, aerospace, metal-working, oil and gas and cutting tools industries via TS and electroplating methods by utilizing more environmental friendly materials, compared to the currently used. The concept of PROCETS is schematically presented in figure 1.



Fig. 1 - Schematic concept of PROCETS

RESULTS AND CONCLUSIONS

Currently, and based on the literature review, there are many outstanding challenges that need to be addressed before product designers can fully apply these principles and make informed decisions about nano-particles.

As mentioned above, PROCETS project aims deliver protective coatings based in nanoparticles, covering a wide range of application, with the replacement of the hazardous process of hard chromium plating and WC-Co coatings via thermal spray by utilizing more environmental friendly materials. To achieve this goal, will be: 1) verify the compliance with standards of all project results, namely REACH, and defining the specific actions to direct the development activities toward the standards; 2) performed a risk management process following the principles and guidelines of the standard ISO 31000 and 31010; 3) performed a completed Life Cycle Assessment (LCA); 4) promote safe practices, based on the available information and literature, during electroplating and thermal spray coatings production (industrial scale), and identify the safer final products according to chemical and physical characterizations performed across the duration of the project.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the funding by European Union's Horizon 2020 (Nº 686135) research and innovation program and the Portuguese Foundation for Science and Technology, in the scope of the project UID/EMS/00712/2013.

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