PROCETS

PROtective composite Coatings via Electrodeposition and Thermal Spraying

The need

Wear and corrosion of materials causes losses of 3-4% of GDP in developed countries, while billions of Euros are spent annually on capital replacement and control methods for wear and corrosion infrastructure. As a result, many important industries are dependent on surface engineering of protective coatings, making it one of the main critical technologies underpinning the competitiveness of EU industry. There are two main techniques that dominate the protective coatings sector: hard chromium (HC) plating and thermal spray (TS). However, HC plating faces a series of issues including negative health and environmental impact leading to the EC restriction of this method for using Cr^{+6} by the end of 2017. Similarly, recent toxicity studies concerning Co-WC cermet applied by TS have revealed that Co-WC particles are toxic in a dose/time-dependent manner. Consequently, there is the necessity of finding new, less hazardous methods and materials exhibiting the same or better performance compared to existing ones.

The scope

PROCETS main target is to deliver protective coatings covering a wide range of applications such as automotive, aerospace, metal-working, oil and gas and cutting tools industries via thermal spray and electroplating methods, by utilizing more environmental friendly materials, compared to the currently used. This will allow the replacement of the hazardous process of hard chromium plating and WC-Co coatings via thermal spray.

Schematic concept of the PROCETS project

TECHNICAL OBJECTIVES

Objectives related to the electroplating process and coatings:

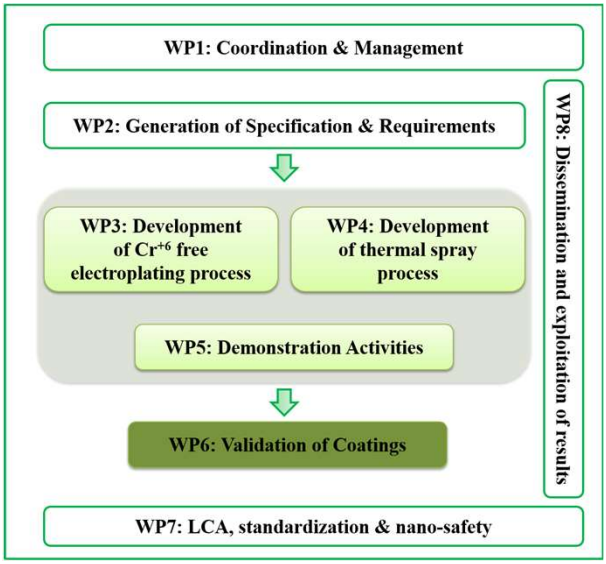
1) Selection of hard (e.g. SiC, Al_2O_3, B_4C) and self-lubricant (e.g. BN, nano-graphite) nano-particles (NP) to be integrated in a Cr^{+6} free electrolytic bath (e.g. Ni-P, Ni-W-P, Cr^{+3}), based on the mechanical performance of the composite coatings.
2) Integration of the NP in the electrolytic baths and formulate stable electrolytic baths with excellent dispersion and prolong lifetime by using appropriate mixture of additives and ultrasonication method.
3) Development of a direct current (DC) electroplating method in pilot lines for applying PROCETS composite coatings with thickness up to 250μm following the requirements of the respective end users. The method will be 3 times faster than conventional hard.
4) Delivery of pilot PC plating lines for applying PROCETS composite coatings with thickness up to 300μm, exhibiting current efficient >70% and superior functional properties by a factor of 20% compared to coatings produced by DC.

Objectives related to the thermal spray process and coatings:

1) Development of green carbide powders by efficient mechanical alloying procedure to be used as feedstock for thermal spraying.
2) Development of a controlled and reproducible enhanced process based on TS to optimize green carbide coatings able to be used to replace WC-Co coatings at industrial level.
3) Development of coatings produced with the developed green carbides materials having controlled and reproducible features/properties.
4) Evaluation and fulfillment of the application requirements.

SCIENTIFIC OBJECTIVES

1) Set-up and integration of NP and operation of the electroplating pilot lines for the application of PROCETS composite coatings at specific components to be tested in operational environment.
2) TS process integration in an industrial pilot-line and evaluation of the coated components.
3) Tenneco test case: Applying the new developed protective coatings by DC and PC electroplating methods at rods to be integrated in shock absorbers.
4) Husqvarna test case: Applying the new developed protective coatings by DC and PC electroplating methods at cutting edges of links to be integrated in chain saws.
5) Chromomed test case – Laminating roller for steel industry: Applying the new TS coatings in rollers to be integrated in laminating machines.
6) Wienerberger test case: applying TS and electro-plating coatings at scraper and mixer components of clay manufacturing industry machines.



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