The Problem
Wear and corrosion of materials causes losses of 3-4% of GDP in developed countries and 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.

PROCETS Overall Objective
PROCETS will optimize a number of scalable methods and properties, in order to provide the next generation of protective coatings. Enabling the shift to more environmentally friendly materials with enhanced properties. The objectives are classified in three groups:

- **Coating and Production**
  - Nanocomposites, by mechanical alloying
  - Electroplating (DC, Pulse Current Plating)

- **Spraying - PROCETS**
  - Protective composite Coatings via Electrodeposition and Thermal Spray

- **Thermal Spraying**
  - Thermal spray coatings: Co-WC particles
  - Improved thermal spraying equipment

The Approach
PROCETS main target is to deliver protective coatings covering a wide range of applications such as automotive, aerospace, metalworking, oil and gas and cutting tools industries via thermal spray and electrodeplating 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.

**Implementation**

- Pilot line of electrodeplating:
  - Nano-particles bath integration
  - Direct Current Plating
  - Pulse Current Plating

- Pilot line of thermal spraying:
  - Production of nano-structured cermets
  - Powder Shaping and Screening
  - Mechanical alloying
  - Application of thermal spray process

**Husqvarna use case**
Currently Husqvarna is searching for environmental friendly alternatives to Cr coatings. Environmental and health safety regulations, will ban the hard chromium process which emits hazardous Cr+6. Thus, Husqvarna will provide the electroplating companies with the necessary un-coated cutter links in order to apply the novel PROCETS composite coatings.

**Tenneco use case**
Currently piston rods are protected by hard chromium coatings. Tenneco is in search for finding a suitable replacement of hard chromium in order to adopt it to its production lines. The electroplating SME members of the consortium will provide the technological solution.

**Cromed use case**
Rollers are the main tool used for laminating in the steel industry. The rollers for laminating must accomplish especially stringent conditions. Their main properties must be: breaking strength, wear resistance, good surface finishing, heat cracking resistance, and scale formation resistance. PROCETS coatings will comply to all the above requirements.

**Expected Impacts**
- Accelerated market uptake of nanomaterials and products in the surface finishing sector
- Improvement in existing manufacturing processes and equipment through integration of nanomaterials, demonstrating better resource efficiency, safety, sustainability and recyclability of a wide variety of components and final products
- Improvement in technical knowledge on the integrated manufacturing processes for nanomaterials in terms of productivity, environmental performance and cost-effectiveness
- Contribution to development of business plans that encourage private sector investment for future business growth
- Promoting safe-by-design approaches in collaboration with the EU nano-safety cluster and contributing towards the framework of EU nanosafety and regulatory strategies

**Project Partners**

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**Procets**
PROCtective composite Coatings via Electrodeposition and Thermal Spraying - PROCETS