

Final Report

Project acronym: *Incomarc*

Project number: 6228

M-ERA.NET Call 2018

Period covered: 01/07/2019 to 31/12/2021

Publishable project summary

The INCOMARC project aims to develop new materials for Electrical Contacts. In particular, the project involved connectors for non-stationary applications and for high and medium power electrical contacts, these are subject to a wide variety of stress such as corrosion, wear, fretting, and erosion due to electric arcs.

Vacuum Circuit Breakers were selected as reference technology for the development of new contact materials, and Cold Gas Spray and Laser Cladding were selected as alternative production processes. The selected coating materials were Copper-Chromium and Copper-Tungsten composites, which offer the best performance in Vacuum Circuit Breakers applications. On the basis of the requirements and scientific literature analyses, and partners' previous experiences, the coating materials were defined in terms of composition of the metallic matrix, and composition, granulometry and volume of reinforcement; several combinations of matrix and reinforcement were investigated.

The powders used as feedstock materials for the deposition process were obtained by high energy ball milling. In the literature there are very few works related to the realization of Cu-Cr and Cu-W coatings by Cold Gas Spray or by Laser Cladding, and in all of them, mixed powders were used instead of composite powders, as in the INCOMARC experimentations, giving to the present project a highly innovative character.

Concerning the Cold Gas Spray, for each powders a series of experiments, following a fraction factorial design, were carried out in order to evaluate the influence of particle temperature and particle velocity on the deposition efficiency, quality of the coating, conductivity, hardness, adhesion, corrosion resistance, etc. deposition efficiency up to 80 % and a porosity and crack free microstructure were obtained.

Concerning the results for Laser Cladding deposition trials, Cu-Cr composites have been successfully cladded on pure Cu substrates. On the other hand, the technique failed in the obtainment of sound coatings from the Cu-W composite powders, since it was impossible to form a stable molten pool. It was due to (i) the very low laser absorptivity of Cu compared to W, and (ii) the large melting point of W higher than the boiling temperature of Cu.

At the end of the INCOMARC project, innovative Cu base coatings, reinforced with Cr or W, were developed and validated at TRL 6.