University of Trento - Doctorate Program in Industrial Innovation

UV-CURABLE PROTECTIVE COATING FOR THE INNER SURFACE OF STEEL PIPES – PhD Thesis Alessandro Condini

Abstract

In recent years, the urgency of environmental and health protection regulations has significantly intensified the search for new, environmentally friendly anticorrosive coatings in heavy industry. While waterborne, high solids or powder coatings have emerged as alternatives, solvent-borne coatings still dominate the market, contributing to polluting and toxic volatile organic compound (VOC) emissions.
UV-curable coatings offer a compelling solution with low environmental impact and efficient production processes that avoid VOC emissions, reduce energy consumption significantly, and lower product costs. Applying UV-curable coatings, which cross-link with UV radiation in a few seconds and without temperature application, is an innovative strategy that could meet the current environmental protection needs. This technology's superiority over traditional ones is evident in its higher production efficiency, avoidance of VOC emissions, lower energy spending production processes, and low investment in the production plant, all of which contribute to reducing product costs and preserving the environment.
The technical-scientific aim of the proposed project is to develop a novel corrosion protective system cross-linked by UV radiation for the inner surface of piping. The system provides a new UV-curable coating formulation with outstanding performance and an effective technology for application and cross-linking inside a pipe's closed space.
The proposed project directly responds to the urgent need for innovation in the pipes industry. The current production processes, which rely on catalytic ovens operating between 80 ˚C and 130 ˚C and using solvent-borne epoxy-based coatings, are highly polluting and energetically expensive, significantly inflating the product's cost. By revolutionizing these processes with a more sustainable and cost-effective solution, we can potentially reduce the overall cost of production, a key benefit that will interest industry stakeholders.
Developing UV-curable coating technology for metal protection represents the new frontier of knowledge for the sustainability of corrosion protection treatments, respecting the environment, the workers' health involved in the process, and the economy of the production processes.

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