PVD (Physical Vapor Deposition) Coating Sustainability Report

Introduction

The European Commission has written the guidelines for the European Industrial Strategy for the coming years. Europe is preparing to make a transition to climate neutrality and digital leadership. The European Industrial Strategy aims to ensure that European industry paves the way for this new era. As the main vehicle for innovation in the various ecosystems, small and medium-sized enterprises (SMEs) must be considered in all actions in this strategy. This is reflected across the board in an increased focus on regulatory burdens for SMEs.
The new actions will strongly benefit SMEs and start-ups, be it a strengthened single market, reduced supply-side dependency or an accelerated green and digital transition. The strategy also includes several measures for SMEs, such as those related to enhanced resilience, combating late payments and supporting solvency.
https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_it

PVD

PVD (Physical Vapor Deposition) coating is an advanced technology used to apply thin films to various
materials, offering improved properties such as hardness, wear resistance, corrosion resistance and aestheticimpr ovements. This technique is used in sectors such as automotive, aerospace, medical and tool manufacturing. The sustainability of PVD is of increasing interest as industry seeks greener methods to produce advanced materials, and PVD stands out as an environmentally friendly process.

Principles of PVD Coating

The PVD process involves the vaporization of a solid material (the target) in a vacuum environment, followed
by condensation of the vapor on a substrate, forming a thin coating. The main techniques include sputtering, evaporation and cathodic arc. Common coating materials include metals (such as titanium and zirconium), alloys and compounds (such as nitrides and carbides).

Sustainability of the PVD 2.0 Process

1. Energy Efficiency
- Energy Consumption: PVD only requires energy to maintain the vacuum and for metal deposition. The technological improvements provided by the new PVD 2.0 have reduced the overall energy consumption, making the process more efficient. This reduction in energy consumption contributes significantly to lowering the overall environmental impact of PVD. The control software has been implemented and the machine's control panel has a real-time energy utilization screen.
- Renewable Energy Sources: The integration of renewable energy sources (solar, wind) into the process PVD process can further lower the environmental impact, making the process even more sustainable.

2. Waste Reduction
- Production of Waste: PVD generates significantly less waste than other coating techniques, as the process is highly controlled and precise. This contributes to a reduction in industrial waste and lower environmental impact.
- Recyclability: PVD coatings can be removed and recycled more easily than chemical coatings, further reducing waste accumulation and promoting a more sustainable material life cycle.

3. Materials Used
- Non-toxic materials: The materials used in PVD are non-toxic and safer for the environment than materials used in other coating processes. This reduces the risk of environmental contamination and public health problems. PVD is applicable on any material/substrate.
- Reduction of Volatile Organic Compounds (VOCs): PVD does not use organic solvents, drastically reducing the emission of VOCs into the environment, which are known to contribute to air pollution and health problems.

4. Environmental Impact
- Greenhouse Gas Emissions: The PVD process, while requiring energy, produces significantly lower greenhouse gas emissions than many chemical coating processes, contributing to the reduction of the manufacturing industry's carbon footprint (see Carbon TAX).
- Lower Environmental Impact: PVD technology has a lower overall environmental impact than coating technologies such as electroplating, which requires the use of chemical baths and produces hazardous liquid waste. The PVD process does not use water. These aspects make PVD an optimal ecological choice.

5. Durability and Performance
- Increased Product Durability: PVD coatings significantly improve the wear and corrosion resistance of products, extending their service life and reducing the need for frequent replacement. This results in less waste and more sustainable finished products. In addition, PVD 2.0 ensures perfect coating uniformity and penetration even with complex geometries, reducing waste.
- Superior Performance: The improved properties of PVD coatings can reduce maintenance costs and improve the efficiency of finished products, offering an additional ecological benefit.

Conclusions

PVD coating represents a technologically advanced solution with significant benefits in terms of environmental sustainability and in harmony with recent regulatory adjustments on production processes. In fact, PVD significantly reduces waste, eliminates the use of toxic materials, and has virtually zero environmental impact. With the further advancement of PVD 2.0 and the adoption of renewable energy sources, PVD can become even more sustainable. Its characteristics of energy efficiency, waste reduction and improved product durability make it an environmentally friendly choice for a wide range of industrial applications.

Notes on PVD 2.0®

PVD 2.0 technology, an evolution of PVD presented by Kolzer, confirms the characteristics of traditional PVD and adds new, important and durable mechanical and chemical performances, compatible with all materials with or without pre-treatment, without the use of heating during the process. The PVD 2.0 process is a sputtering PVD coating where the molecule is energized by the high-power magnetron and, with the help of process gases, a dense, compact and extremely durable coating is obtained. Both decorative and technical coatings can be obtained with this process.

The new generation Kolzer MK34' plants for the application of PVD 2.0 physical coatings offer high processing speeds and significant production volumes thanks to optimized processes (all digitized) and the presence of two ports for simultaneous loading and unloading of parts. These features make them ideal for integration with industrial production lines. One of the features appreciated in any industry, and particularly where design is of great importance, is the ability to generate any color and coat any material, be it metal, plastic or glass.

During the vacuum process, the machine can generate a powerful atomization of metals, forming an impact zone that applies a dense coating to parts of any shape or geometry, guaranteeing uniform and perfect coverage.
In addition, it allows a wide range of elegant and contemporary shades, including black, to be obtained, enhancing the qualities and technical characteristics of the treated surfaces.

Kolzer MK34' is an easy-to-use and easy-to-install (plug and play) machine and can install up to 3 MS PVD 2.0 sources to achieve any color: vacuum is achieved in 4 minutes. Activation of PLASMA Ultra accelerates preparation prior to deposition, making the machine super-fast.

Sources

- **Internal sources based on general and technical knowledge.**
- **Scientific and technical articles on PVD processes and sustainability.**
- **European Commission website.**

Notes

The attached document, produced by the European Commission's Directorate-General for Research and Innovation, proposes a coherent vision for the future of European industry, which we call 'Industry 5.0'. This vision recognises its capacity to achieve social objectives beyond growth and employment, its ability to become a resilient provider of prosperity, with production respecting the limits of the planet and putting the wellbeing of industrial workers at the heart of the production process. For more information contact us at carlo.gennari@kolzer.com