MOZART

METAL MATRIX NANO-COMPOSITE COATINGS UTILIZATION AS ALTERNATIVE TO HARD CHROMIUM

8th Press Release

MOZART Project Successfully Concludes After 48 Months of Innovation Towards Sustainable Surface Finishing

After four years of collaborative research and innovation, the Horizon Europe project MOZART (Metal Matrix Nano-Composite Coatings Utilization as Alternative to Hard Chromium) has successfully concluded, delivering sustainable and high-performance alternatives to conventional hard chromium coatings for the European manufacturing industry.

Over its 48-month duration, the project successfully combined advanced material science, artificial intelligence, pilot-scale manufacturing, environmental assessment, and digital decision-support technologies to create innovative Ni-matrix nanocomposite coatings suitable for demanding industrial applications such as piston rods and gear components.

One of the project's major scientific breakthroughs was the use of Generative Artificial Intelligence for the design of safer chemical alternatives to boric acid, a commonly used but environmentally problematic substance in electroplating processes. Through AI-driven inverse molecular design and optimization algorithms, the consortium identified promising sustainable alternatives while significantly reducing laboratory experimentation and waste generation.

The MOZART consortium also achieved significant progress at pilot scale, successfully validating REACH-compliant coating chemistries under industrially relevant conditions. The project demonstrated Ni/SiC coatings with hardness values exceeding 1000 HV, matching or surpassing the performance of traditional hard chromium coatings. In parallel, graphene- and WS_2-enhanced coatings achieved coefficients of friction below 0.15, offering highly promising solutions for energy-efficient gear applications.

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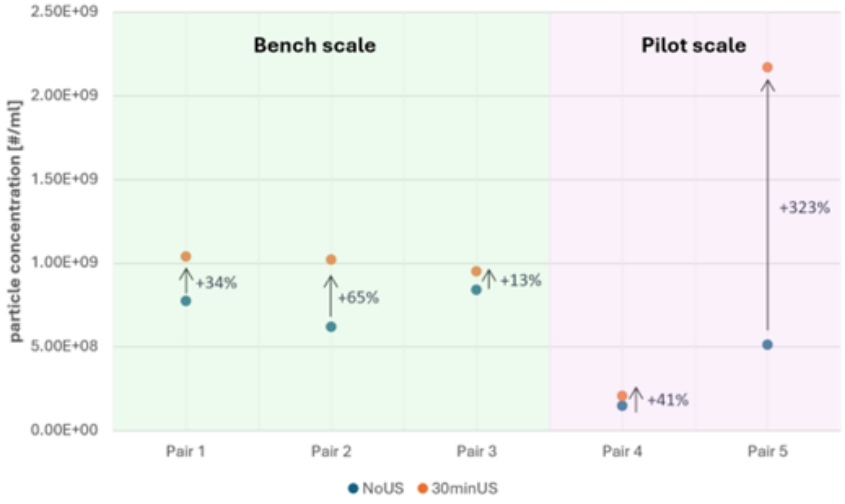
A key innovation within the project was the development of a real-time nanoparticle monitoring system by Brave Analytics, enabling precise characterization and control of electroplating bath conditions at pilot scale.



Beyond technical performance, MOZART delivered substantial environmental benefits. Life Cycle Assessment and pilot-scale validation activities confirmed approximately 70% reduction in waste generation and hazardous sludge formation compared to conventional hard chromium processes. Additionally, the project successfully eliminated the use of boric acid and hexavalent chromium (Cr^{6+}), improving worker safety and ensuring full REACH compliance.

To support long-term industrial uptake, the project also leaves behind an important digital legacy through the c-safe Decision Support Tool developed by AXIA Innovation GmbH. The web-based platform integrates technical, environmental, economic, and SSbD indicators into a user-friendly interface that enables manufacturers to assess, compare, and optimize sustainable coating solutions according to their specific industrial needs.

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AXIA INNOVATION

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The c-safe tool has already been validated through real-world replication cases within the surface finishing industry and is expected to continue supporting the transition towards greener manufacturing processes across Europe.

The successful completion of MOZART demonstrates that sustainability and industrial performance can go hand in hand. By integrating AI-driven molecular design, advanced nanocomposite coatings, real-time monitoring technologies, and SSbD methodologies, the project has established a strong foundation for the future of environmentally responsible surface engineering in Europe.

For more information about the project and its results, visit: [MOZART Project Website]

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