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WISE

Multi-scale multi-process machine for high value-added complex products with disruptive functionalities

PARTNERS

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ABOUT THE PROJECT

The WISE project aims to develop a TRL7 multi-process machine by integrating high-precision, multi-scale processing techniques for producing parts with advanced smart functionalities.

GOALS

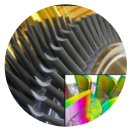
a) Create a machine architecture with components (WP5) based on the TRL5-validated output of Mesomorph.
b) Develop processing modules and related equipment (WP4,5,6,7), all originating from TRL5-validated outputs of 4DHybrid, Symbionica, Atlantis, and Pulse.
c) Formulate new design principles and rules (WP2,3) to enable smart functional part production, drawing from TRL5-validated output of Mesomorph.
d) Establishing an AI-AE Platform (WP3) for flexible and resilient production via data-driven Digital Twins and lifetime modelling, using TRL5-validated output of Mesomorph.

USE CASE

1

Functionalized prosthesis with biomolecules diffusion control for optimized adhesion of living tissues.

2



Turbine blade with self-healing properties exploiting high working temperatures to enable autonomous repair mechanism.

3

Smart repair patches for pipes capable to actively repair detected cracks and restore the component's structural integrity.

INNOVATIVE FUNCTIONALITIES

F1 – Triggered Biomolecules Diffusion (TBioD)

The spinal prosthesis, made from biocompatible alloys (e.g., Ti-6Al-4V), is coated with nanostructures to enhance biomolecule adhesion and promote bone integration. Non-osseointegrating surfaces are treated with a ceramic layer for better biocompatibility and resistance. Biomolecule transport is activated by local electromagnetic fields, improving surgery success rates, recovery speed, and reducing complications.

F2 – Self-Healing (SH)

Smart CCMs with self-repair are designed for extreme environments. Turbine blades use advanced alloys with High-Entropy CCMs for self-repair in harsh conditions, up to 1500°C. The Ni-based superalloy core is coated with a CCA layer stable up to 700°C, while the CCO skin provides thermal insulation, improving wear and corrosion resistance.

F3- Smart Repairing (SR)

Smart CCMs with self-repair are designed for extreme environments. Turbine blades feature Ni-based superalloy cores, with CCA coating stable up to 700°C and CCO skin for thermal insulation, wear, and corrosion resistance, operating at temperatures up to 1500°C.