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EDITION 4,
AUGUST 2025

AID4GREENEST

AI-Powered Characterisation and Modelling for Green Steel Technology

WHAT IS AID4GREENEST?

AID4GREENEST is a three-year (September 1, 2023 – August 31, 2026) Horizon Europe project with a budget of more than 5 million EUR. It aims to develop a range of new Artificial Intelligence-based rapid characterisation methods and modelling tools for the steel sector.

IN THIS EDITION

- AID4GREENEST and the 75th anniversary of the Schuman Declaration
- Advancements in heat treatments for prototype turbine shaft
- Latest project news and activities
- And more...

FORGING EUROPE'S FUTURE: AID4GREENEST BUILDS ON STEEL'S LEGACY

Welcome to our latest project newsletter! This year, we celebrate 75 years of the Schuman Declaration, which laid the foundation for the European Union. The steel industry was at the heart of this historic moment – a legacy we can truly be proud of.

Our AID4GREENEST project carries forward this tradition, revolutionising steel production through sustainability and innovation. Our dedicated team of researchers, consultants, and project managers continues to drive remarkable progress toward a cleaner, greener future.

Thank you for joining us on this meaningful journey that connects our past achievements with our future aspirations!

Dr. Ilchat Sabirov
AID4GREENEST Project Coordinator
IMDEA Materials Institute

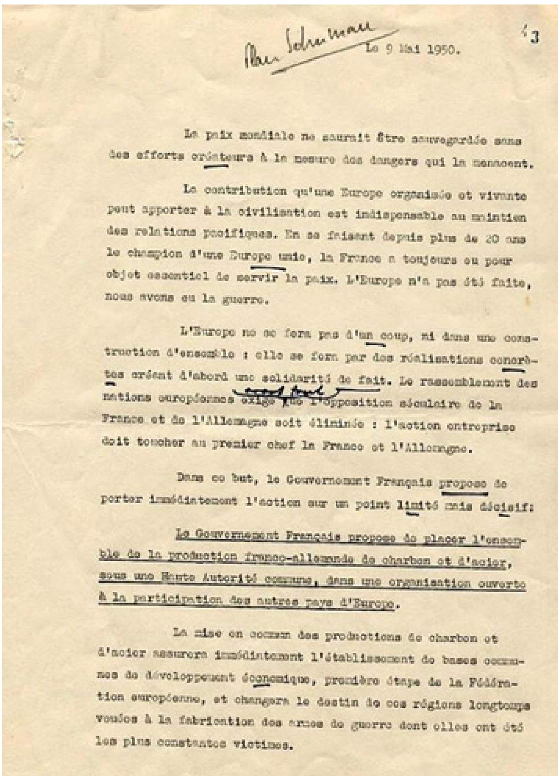
AID4GREENEST and the legacy of European Unity: 75 years after the Schuman Declaration

This year marks the 75th anniversary of the Schuman Declaration, a statement delivered on May 9th, 1950, by French Foreign Minister Robert Schuman that would change the course of European history.

Proposing the creation of a Europe-wide institution to manage coal and steel production jointly, Schuman planted the seed that would grow into today's European Union. The aim was clear: to prevent war through economic and political integration, starting with industries at the heart of post-war reconstruction and conflict.

Three-quarters of a century later, Europe continues to draw strength from this spirit of cross-border cooperation, particularly in addressing the complex challenges of our time. In this context, the AID4GREENEST project reflects the same ethos that guided the Schuman Declaration, but in a modern context.

Where the original plan focused on coal and steel as tools for peace, AID4GREENEST focuses on steel and artificial intelligence as drivers of sustainability, innovation, and resilience.


Robert Schuman 3

Le 9 Mai 1950.

La paix mondiale ne saurait être sauvegardée sans des efforts créateurs à la mesure des dangers qui la menacent.

La contribution qu'une Europe organisée et vivante peut apporter à la civilisation est indispensable au maintien des relations pacifiques. En se faisant depuis plus de 20 ans le champion d'une Europe unie, la France a toujours eu pour objet essentiel de servir la paix. L'Europe n'a pas été faite, nous avons eu la guerre.

L'Europe ne se fera pas d'un coup, ni dans une construction d'ensemble : elle se fera par des réalisations concrètes créant d'abord une solidarité de fait. Le rassemblement des nations européennes exige que l'opposition séculaire de la France et de l'Allemagne soit éliminée : l'action entreprise doit toucher au premier chef la France et l'Allemagne.

Dans ce but, le Gouvernement Français propose de porter immédiatement l'action sur un point limité mais décisif:

Le Gouvernement Français propose de placer l'ensemble de la production franco-allemande de charbon et d'acier, sous une Haute Autorité commune, dans une organisation ouverte à la participation des autres pays d'Europe.

La mise en commun des productions de charbon et d'acier assurera immédiatement l'établissement de bases communes de développement économique, première étape de la Fédération européenne, et changera le destin de ces régions longtemps vouées à la fabrication des armes de guerre dont elles ont été les plus constantes victimes.

Declaration of 9 May 1950.

However, the project's full scope goes beyond technology development. It includes the creation of a strategic roadmap for model-based innovation processes in the steel industry, fully aligned with European priorities: enhancing material quality, reducing carbon emissions, minimising waste, and securing critical raw materials.

Robert Schuman delivers his declaration in Paris.

A Modern Model of European Cooperation

Just as the European Coal and Steel Community brought together countries in the wake of conflict, AID4GREENEST unites partners in pursuit of sustainable growth and technological leadership.

The project consists of a consortium of 11 partners from 5 European countries, a mix of leading universities, research centres, steel producers, and companies. Together, they embody the collaborative, interdisciplinary, European spirit that has long been central to Europe's research and innovation success.

While the challenges have changed since 1950, the need for shared solutions and mutual support has not. Climate change, resource scarcity, and digital transformation require precisely the kind of joint commitment and knowledge-sharing that projects like AID4GREENEST make possible.


The signing of the Treaty of Paris on 18 April 1951, which formally established the European Coal and Steel Community (ECSC)

Looking Forward

As AID4GREENEST continues full speed ahead, the consortium continues to advance on multiple fronts: refining technical developments, aligning priorities with industry needs, and laying the groundwork for the roadmap that will guide European steel innovation for years to come.

In commemorating the 75th anniversary of the Schuman Declaration, we are reminded that cooperation is not only a historical ideal, it remains a living principle. From peace to sustainability, from reconstruction to green transition, Europe thrives when it works together.

AID4GREENEST is proud to be part of that ongoing story.

You can read the original Schuman Declaration, here.

Advances in heat treatments for prototype turbine shaft

Carlos Llovo
Metallurgy and Process Researcher
Reinosa Forgings and Castings

As part of Reinosa Forgings and Castings' (RF&C) ongoing work on the AID4GREENEST project, we have recently completed the quality heat treatment sequence for the prototype shaft, which ended with a stress-relief that complements previous quenching and tempering processes. In order to verify the soundness of the heat treatment design, the Quality team at RF&C has measured surface residual stresses via the Ring-core method at the process completion. This method is a sophisticated approach that detects how much stress remains on the material by observing the relaxation of a small core machined on the surface.

Results have shown that the stresses are distributed evenly throughout the length of the shaft, and that different diameters do not show significant differences. Also, stresses are reported to be compressive and lower than 25 MPa, thus qualifying for industrialised manufacturing according to well-established standards.

Key Findings:

- Stress Distribution: Residual stresses are evenly distributed along the shaft's length, with no significant variations across different diameters.
- Stress Magnitude: Compressive residual stresses are below 25 MPa, aligning with industrial manufacturing standards.
- Mechanical Properties: Mechanical testing before and after the final heat treatment stage indicates that the process effectively reduces residual stress levels while maintaining tensile properties.

Also, RF&C has performed mechanical testing before and after the completion of this last heat treatment stage, with the intention of highlighting any significant change in tensile properties.

It was therefore verified, by testing samples on equivalent locations, that this heat treatment can effectively reduce the residual stress levels, while maintaining mechanical properties almost intact. This has been achieved by setting a soaking temperature 30°C below the previous tempering temperature.

Finally, RF&C has recently completed all machining stages required during the summer. The shaft now presents a smooth and shiny finish and is finally ready for the Heat Stability Test. This brings an end to RF&C first set of activities and will be followed by the shipment of the shaft to Czechia, where this very demanding test will be conducted.

There, the dimensional stability at temperatures above 600 °C will be assessed, checking whether it can be safely used as a core component of steam-based energy generation turbines.

Development of a model predicting thermal gradients and microstructure during quenching of large shafts

Dr. Aarne Pohjonen
Postdoctoral Researcher
University of Oulu

Prof. Mahesh Somani
Professor
University of Oulu

Rishabh Bharadwaj
Doctoral Researcher
University of Oulu

In close collaboration with our project partners at Reinosa Forgings and Castings, the University of Oulu team has developed a numerical model to simulate oil quenching of the large shaft.

The model consists of a heat transfer and conduction model, which is fully coupled with a phase transformation model. This approach allows us to model the recalescence effect, which has non-negligible effect on the temperature evolution within the shaft. Since the phase transformations are affected by the local temperatures, this effect causes a feedback loop, and must be included in the simulations in order to obtain realistic results.

To parameterise the model, we performed continuous cooling transformation (CCT) experiments where the phase transformations during cooling could be measured by dilatometer, corroborated with metallography examinations performed for samples that had been cooled at different rates. The experimental results were used in non-linear fitting of the phase transformation model.

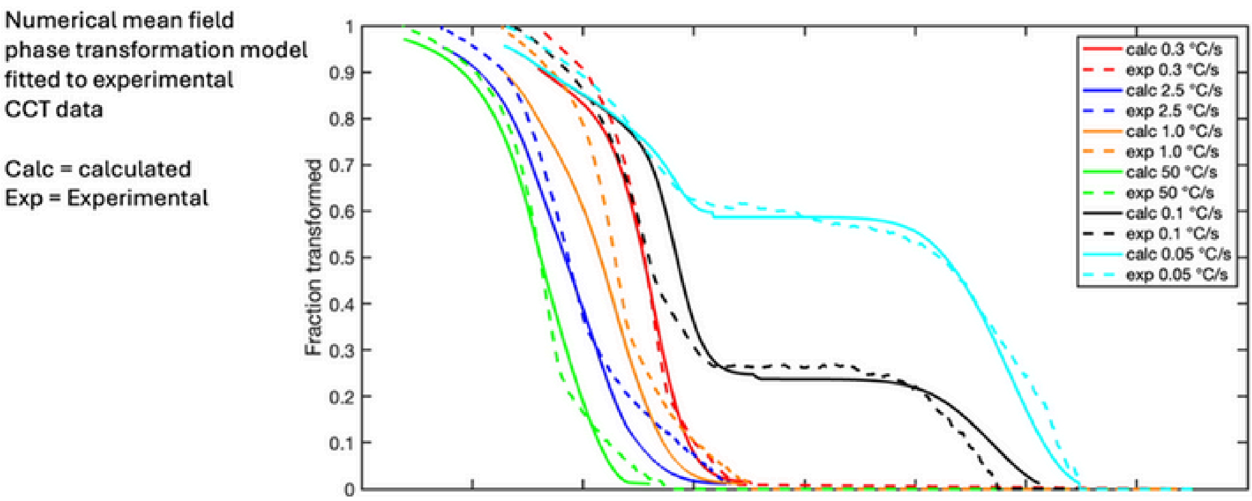


Figure 1. Numerical mean field phase transformation model fitted to experimental CCT data. Experimental work conducted by R. Bharadwaj, under the supervision of Prof. M. Somani.

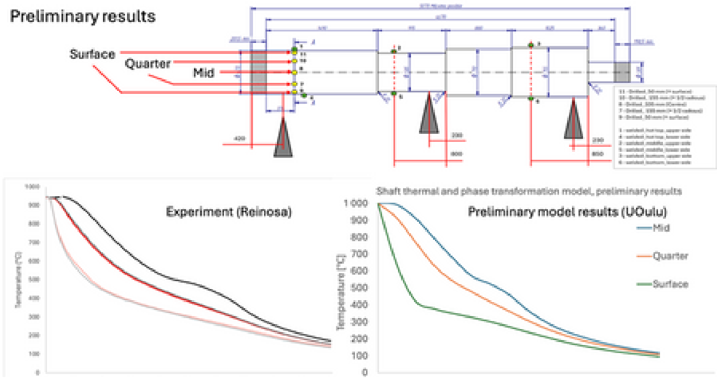


Figure 2. Experimentally measured temperatures from the industrially produced shaft during cooling, and preliminary results from numerical model.

The recalescence effect, i.e. the slowing down of cooling due to the heat released from phase transformation is included in the model. The preliminary results shown in Figures 2, 3 and 4 depict the effect and relate it to formation of bainite.

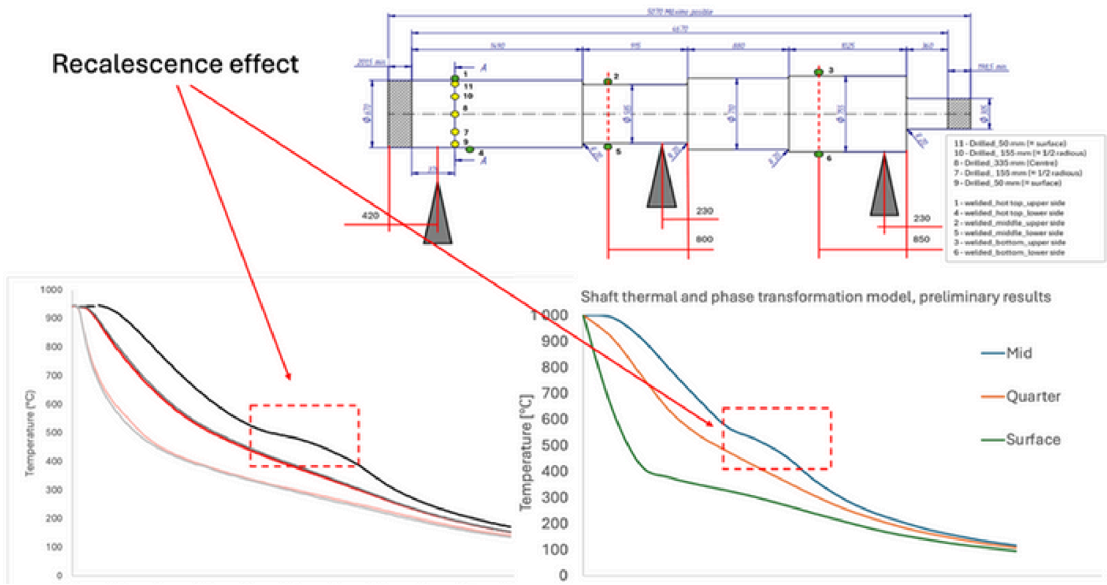


Figure 3. The recalescence effect, i.e. the heat release due to phase transformations, which is clearly observed in the experimental data is reproduced in the numerical simulations.

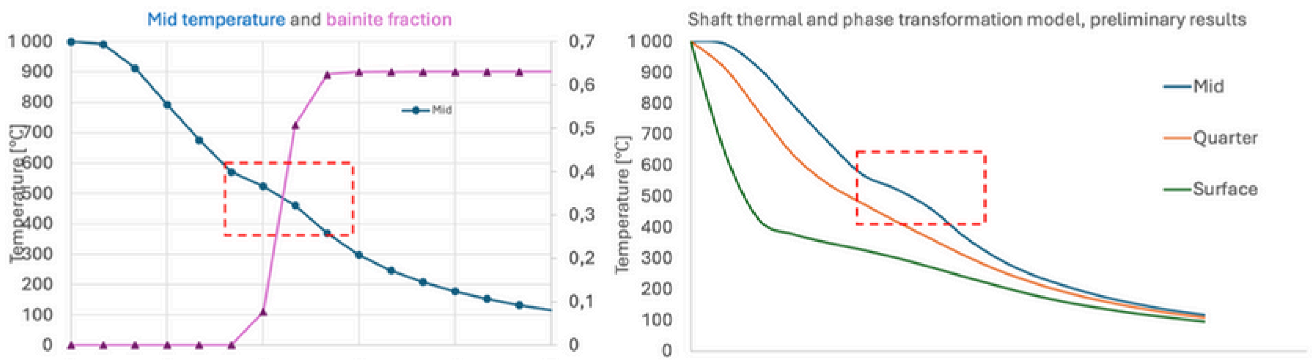


Figure 4. The observed recalescence effect can be attributed to bainite reaction, which occurs at the relevant temperature range (400 – 600 °C).

The preliminary results illustrate the model's capability in calculating the resulting phase distribution after quenching. As an example, the fractions of ferrite (Figure 5) are shown, while the martensite fractions at the surfaces at the edges are shown in Figure 6.

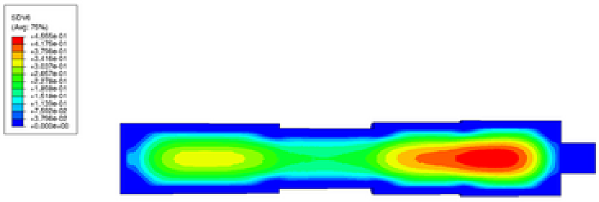


Figure 5. Simulated ferrite fraction after quenching (preliminary results).

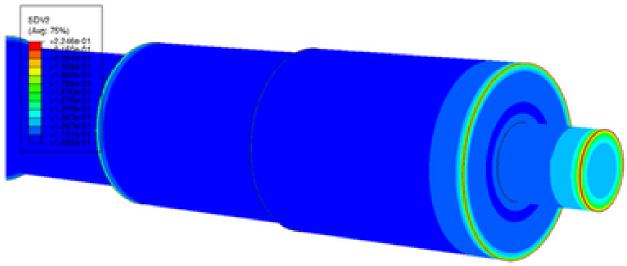


Figure 6. Simulated martensite fraction at the edges.

Although the model has been fully developed and operational, we are still fine-tuning certain parameters. In particular, we are fitting the heat transfer coefficient with further experiments to understand the effects of oxide scale formation and oil flow. For this purpose, further experiments have been planned at the University of Oulu for varying the oil flow rate near the test piece and measuring the temperature at different depths. Further, we are collaborating with fellow project partner GIT to obtain a detailed understanding of the oxide scale formation in relevant conditions, and its effect on the heat transfer between the steel surface and oil.

To understand the local fluid flow, we have also constructed computational fluid dynamics simulations (CFD), which can be used to calculate the local flow rate near surfaces. The aim of this study is to examine the effect of quench direction (in axis direction versus perpendicular to the axis direction) on the heat transfer. The initial implementation of the CFD model and a simulated test case is shown in Figure 7.

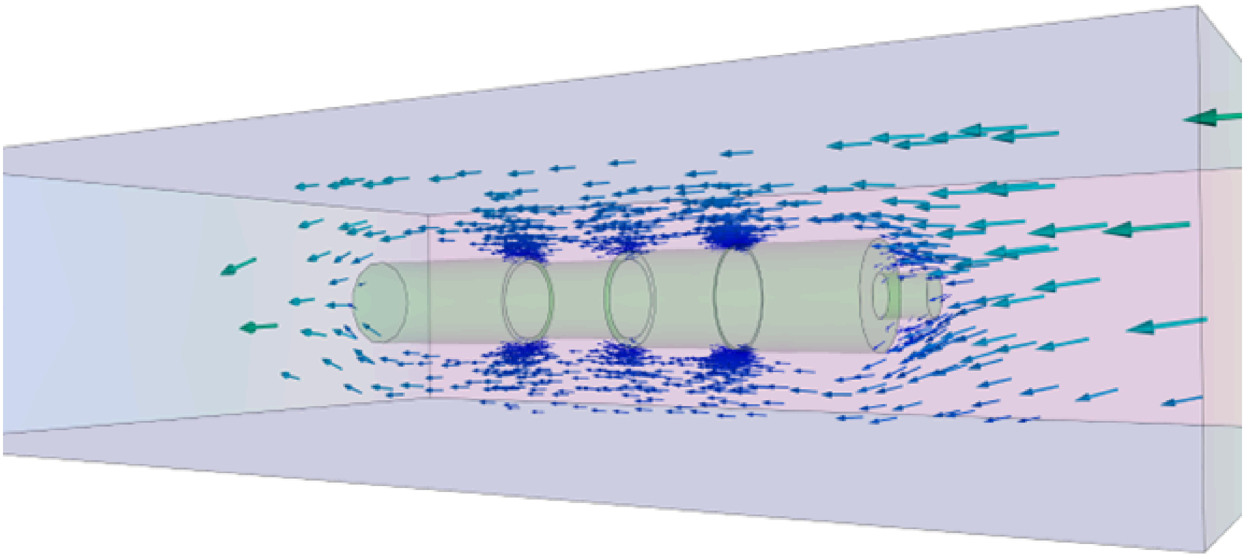


Figure 7. Computational fluid dynamics model was constructed for simulating local fluid flow near the shaft. The model will be applied to examine the local flow rates when quenching is performed in axial direction and perpendicular to the axis.

PROJECT NEWS

ŁUKASIEWICZ – GIT JOINS AID4GREENEST TO STRENGTHEN HIGH-TEMPERATURE STEEL RESEARCH

Polish research institute Łukasiewicz – GIT brings invaluable expertise in creep testing and surface oxidisation to AID4GREENEST, supporting the development of advanced AI-based tools for steel characterisation and modelling. **Read more...**

SHARING INSIGHTS FROM AID4GREENEST'S MATERIALS RESEARCH: SUMMER SCHOOL MATERIOMICS

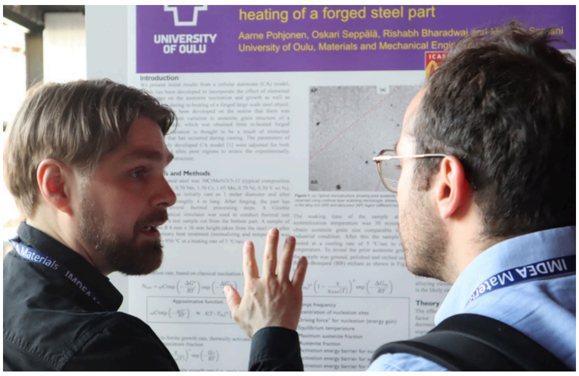
AID4GREENEST researcher, Dr. Michael Sluydts from ePotentia, shared insights on materials research related to the company's ongoing work on implementing Artificial Intelligence solutions in the steel manufacturing industry. **Read more...**

DEVELOPING PIONEERING DIGITAL SOLUTIONS FOR SUSTAINABLE STEEL MANUFACTURING

Dr. Ilchat Sabirov, coordinator of the AID4GREENEST project and Principal Investigator at IMDEA Materials Institute, shared invaluable insights on developing pioneering digital solutions for sustainable steel manufacturing at the Future Steel Forum in Barcelona, Spain. **Read more...**

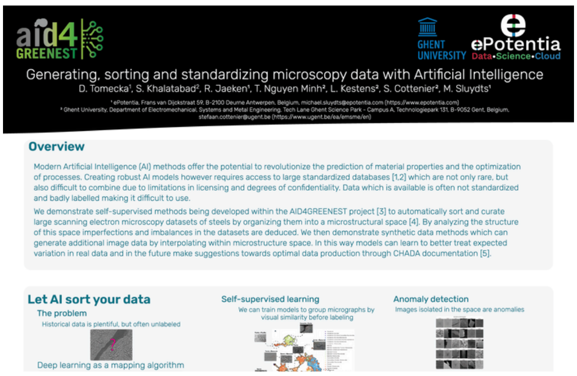
BRIDGING THE GAP BETWEEN AI TOOLING AND INDUSTRIAL NEEDS: FLANDERS AI FORUM

AID4GREENEST researcher, Dr. Daria M. Tomecka from ePotentia, has taken part in the Flanders AI Forum 2025, contributing to two cutting-edge sessions on Dutch-language large language models and agentic AI. **Read more...**



UNDERSTANDING SEGREGATION AND GRAIN GROWTH: AID4GREENEST'S AARNE POHJONEN AT ICASP 7

At ICASP7, AID4GREENEST and University of Oulu researcher Dr. Aarne Pohjonen, presented insights into solidification-induced segregation and its impact on grain growth during the heating of forged steel components. **Read more...**



AID4GREENEST AND THE GENERATION OF SYNTHETIC STEEL MICROSTRUCTURES AT ML4SPEC2025

ePotentia and AID4GREENEST researcher, Dr. Daría Tomecka, presented both a contributed talk and a poster at this year's ML4Spec2025 event at the Belgian-German WE-Heraeus Seminar on ML for Spectroscopy, hosted at Vrije Universiteit Brussel (VUB). **Read more...**

PROJECT NEWS CONT.

AID4GREENEST'S DR. CHRISTINA SCHENK PRESENTS NOVEL CALIBRATION TOOL AT COUPLED PROBLEMS

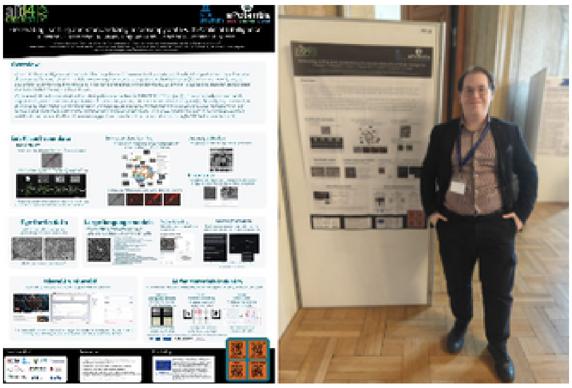
IMDEA Materials Institute's Dr. Christina Schenk presented her latest research at the XI International Conference on Coupled Problems in Science and Engineering (Coupled Problems 2025), held in Villasimius, Sardinia. **Read more...**

HOW GENERATIVE ARTIFICIAL INTELLIGENCE CAN HELP COMPLETE MATERIALS DATASETS

ePotentia and AID4GREENEST researcher, Dr. Michael Sluydts, showcased how generative artificial intelligence (AI) is revolutionising materials dataset completion, as part of the company's research within the Horizon Europe AID4GREENEST project. **Read more...**

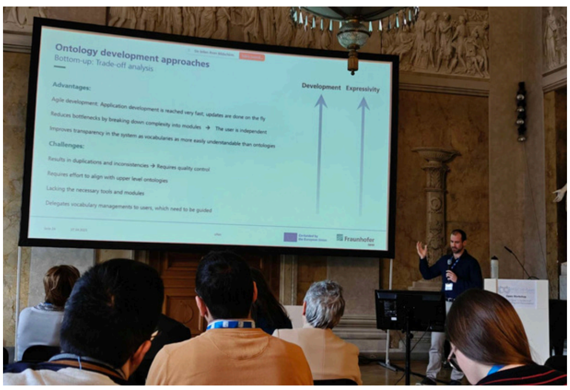
ENSURING RESEARCH DATA IS FINDABLE, ACCESSIBLE, INTEROPERABLE, AND REUSABLE

AID4GREENEST researchers, Kiran Kumaraswamy and Yoav Nahshon (Fraunhofer IWM), presented a Hands-On Webinar on the importance of standardised and FAIR documentation processes, such as characterisation, modelling and manufacturing. **Read more...**



AID4GREENEST SHOWCASED AT 5TH EMMC INTERNATIONAL WORKSHOP

Dr. Michael Sluydts of ePotentia, a partner in the AID4GREENEST project, recently took part in the 5th International Workshop organised by the European Materials Modelling Council (EMMC ASBL). **Read more...**



AID4GREENEST PRESENTS ON DATA LIFE CYCLES IN MATERIALS MODELLING AND CHARACTERISATION

Yoav Nahshon of Fraunhofer IWM, representing the AID4GREENEST Project, took part in the MatCHMaker - HorizonEU Workshop on Data Life Cycles in Materials Modelling and Characterisation, held at the Vienna University of Technology. **Read more...**

MEET THE NEWEST AID4GREENEST MEMBERS

Krzysztof Radwański
Łukasiewicz – GIT

Dr. Krzysztof Radwański is a materials science expert and Head of the Research Group for Investigations of Properties and Structure of Materials at the Upper Silesian Institute of Technology. Specialising in steel technologies, protective coatings, and electron microscopy, he has authored a monograph on EBSD and 163 publications. He holds 7 patents and has led or contributed to 32 research projects. With over 500 technical analyses conducted, his work supports industrial innovation. An active member of ESTEP, EMS, IFSEM, and the Polish Academy of Sciences, he fosters international collaboration in materials science.

Łukasz Poloczek
Łukasiewicz – GIT

Dr. Eng. Łukasz Poloczek is a leading expert in process simulation and Head of the Research Group for Processes Simulation. With extensive experience in academic and industrial research, he has led or contributed to over 90 projects focused on simulation methodologies and manufacturing optimisation. He has authored over 50 publications in peer-reviewed journals and conferences. His work bridges theoretical research and industrial applications, advancing computational simulations and innovative manufacturing solutions. He collaborates with research institutions and industry partners to integrate cutting-edge simulation techniques into real-world manufacturing systems.

Roman Kuziak
Łukasiewicz – GIT

Prof. Roman Kuziak, Ph.D. is a distinguished researcher with 45 years of experience in material science, process engineering, and industrial applications. He has led or contributed to over 300 research projects with top institutions and industries, driving innovation in manufacturing and material optimisation. His work includes over 150 peer-reviewed publications on advanced materials, metallurgical processes, and computational modelling. Committed to interdisciplinary collaboration and technological innovation, his research bridges fundamental science and industry, helping develop modern production technologies and improving industrial applications.

Jarosław Opara
Łukasiewicz – GIT

Dr. Eng. Jarosław Opara is a specialist in computational material science. With over 15 years of experience, his work focuses on numerical and physical simulations of metallurgical processes, particularly phase transformations in steels. He develops models in C++—notably using the Cellular Automata method—to simulate microstructural evolution during annealing and cooling, generating both continuous cooling transformations (CCT) and time-temperature-transformation (TTT) diagrams. Jarosław's laboratory work involves performing physical simulations using deformation dilatometers and the Gleeble 3800 simulator.

STANDARDISATION ACTIVITIES/COLLABORATION

AiMPACT

ADVANCED MATERIALS MODELLING & CHARACTERISATION CLUSTER

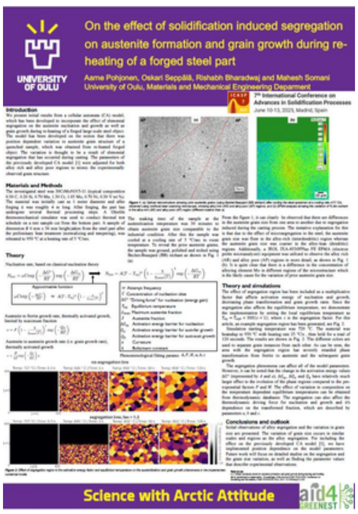
Over the past six months, AID4GREENEST has continued our collaboration with sister and partner Horizon Europe projects: AddMorePower, CoBRAIN, D-STANDART, Knowskite-X and MatCHMaker as part of the **Advanced Materials Modelling & Characterisation** (AiMPACT) Cluster. This has included AID4GREENEST's participation in April's MatCHMaker - Horizon EU Workshop on Data Life Cycles in Materials Modelling and Characterisation, as well as ongoing collaboration on communication and dissemination efforts to broaden societal awareness and impact of the work being done as part of these innovative projects.

Sister and partner projects

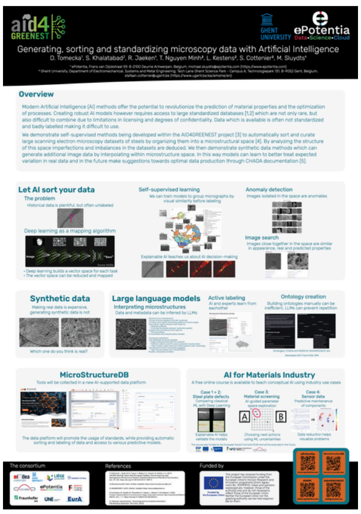
AddMorePower · CoBRAIN · DiMAT · D-standart · KNOWSKITE-X · MatCHMaker

AID4GREENEST POSTER GALLERY

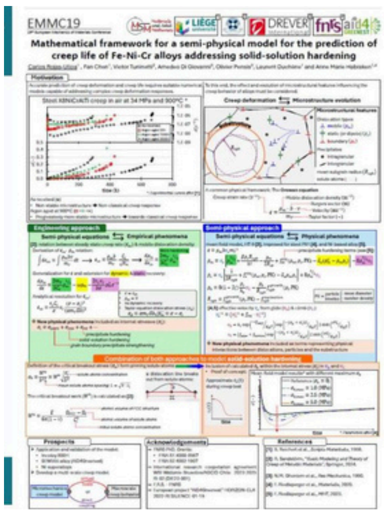
On the effect of solidification induced segregation on austenite formation and grain growth during re-heating of a forged steel part



Generating, sorting and standardising microscopy data with Artificial Intelligence



Mathematical framework for a semi-physical model for the prediction of creep life of Fe-Ni-Cr alloys addressing solid-solution hardening



LATEST PROJECT VIDEOS

A4G WEBINAR - DIGITISING PROCESSES IN A FAIR AND STANDARDIZED MANNER

AID4GREENEST PARTNER IN FOCUS - FRAUNHOFER IWM

MEET THE AID4GREENEST TEAM: JEROME TCHOUFANG TCHUINDJANG

Follow us on YouTube for more multimedia content, here.

UPCOMING EVENTS

The AID4GREENEST consortium is organising a symposium titled "Artificial Intelligence, Modelling, and Data Science in Advanced Alloy and Process Design" in Area D: ***"Characterization, Modelling, and Artificial Intelligence"*** at the EUROMAT 2025 Congress in Granada (September 14-18, 2025). More information. **Find out more...**

UPCOMING EVENTS CONT.

AID4GREENEST'S DR. MAXIM ZAPARA TO PARTICIPATE IN THE INTERNATIONAL FORGING CONGRESS 2025

AID4GREENEST and Fraunhofer IWM researcher Dr. Maxim Zapara will give a plenary talk in the *Innovations in Forging* session at the International Forging Congress 2025 in October. **Find out more...**

EPOTENTIA AND FRAUNHOFER IWM TO PRESENT AID4GREENEST AT AIMSE2025

AID4GREENEST will be well represented at AIMSE2025 with researchers from ePotentia and Fraunhofer IWM taking part in the 2nd conference on Artificial Intelligence in Materials Science and Engineering in Germany. **Find out more...**

Thank you for signing up for the AID4GREENEST newsletter. Our next edition will be released in February 2026. Until then, follow us at our website: www.aid4greenest.eu.

And don't forget to follow us on our social media channels

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