MatCHMaker
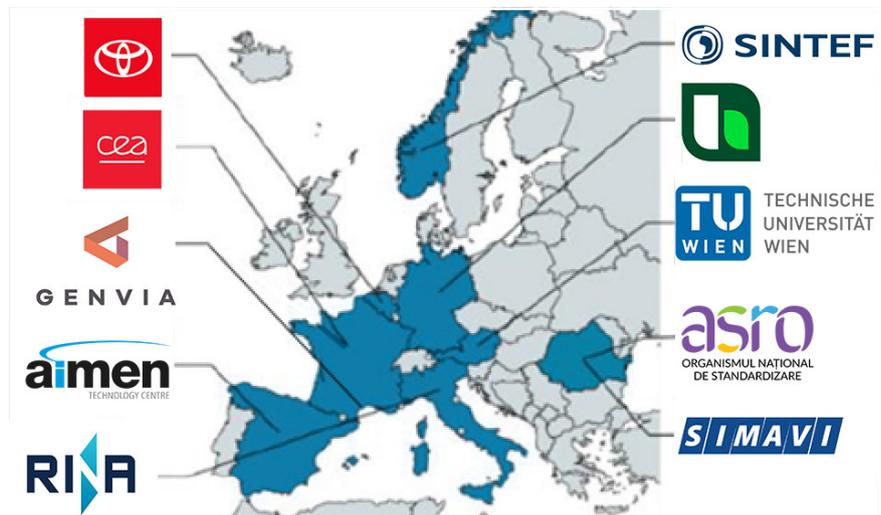Materials Characterisation & Modelling

NEWSLETTER #6
February 2026

Open data and industry-driven environment for materials characterisation and modelling combing physics and data-based approaches

SINTEF

TECHNISCHE UNIVERSITÄT WIEN

asro
ORGANISMUL NATIONAL DE STANDARDIZARE

SIMAVI

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aimen
TECHNOLOGY CENTRE

RINA

Content

Use Case I Construction

Decrease CO2 emissions in cement production
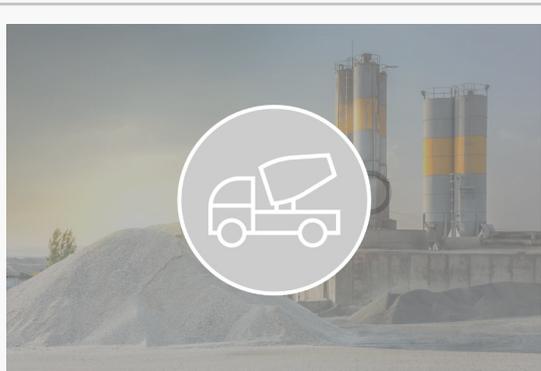
To decrease CO2 emissions from cement production, substituting conventional cement with supplementary cementitious materials (SCM) is key. Currently, the European cement sector still heavily incorporates by-products of the steel and coal industries. Looking ahead, the challenge lies in finding the maximum replacement level of these alternatives while maintaining or improving the performance.

Use Case III Mobility

Emission-free power in multiple mobility applications

Analytical and computational tools enable a better understanding of degradation in fuel cells. The MatCHMaker aims to develop new future high-performance material by enhancing analytical and computational analysis in this use case.

The focus lies on improving the durability and performance of proton-exchange membrane fuel cells (PEMFC) for mobility applications.

Using Machine Learning to make Materials Research Faster and Smarter

The MatCHMaker project is harnessing the power of machine learning (ML) to make materials research more efficient, accurate, and data-driven. By applying intelligent algorithms to experimental and modelling work, researchers can gain deeper insights into material behaviour and significantly speed up research workflows.

Led by AIMEN, the project team is exploring several real-world applications. In construction materials, ML models can predict the strength of cement at various stages, helping researchers and engineers conduct quicker and more informed tests. In clean energy technologies, advanced image analysis tools automatically interpret microscopic images of materials, dramatically reducing the time normally spent on manual observation.

Early investigations also show promise in applying ML to describe micro- and nanoparticles used in fuel cells, paving the way for improved designs and performance in future energy systems.

Together, these developments illustrate the potential of machine learning to complement traditional research methods, enhance scientific understanding, and set the stage for more advanced data-driven solutions later in the MatCHMaker project.
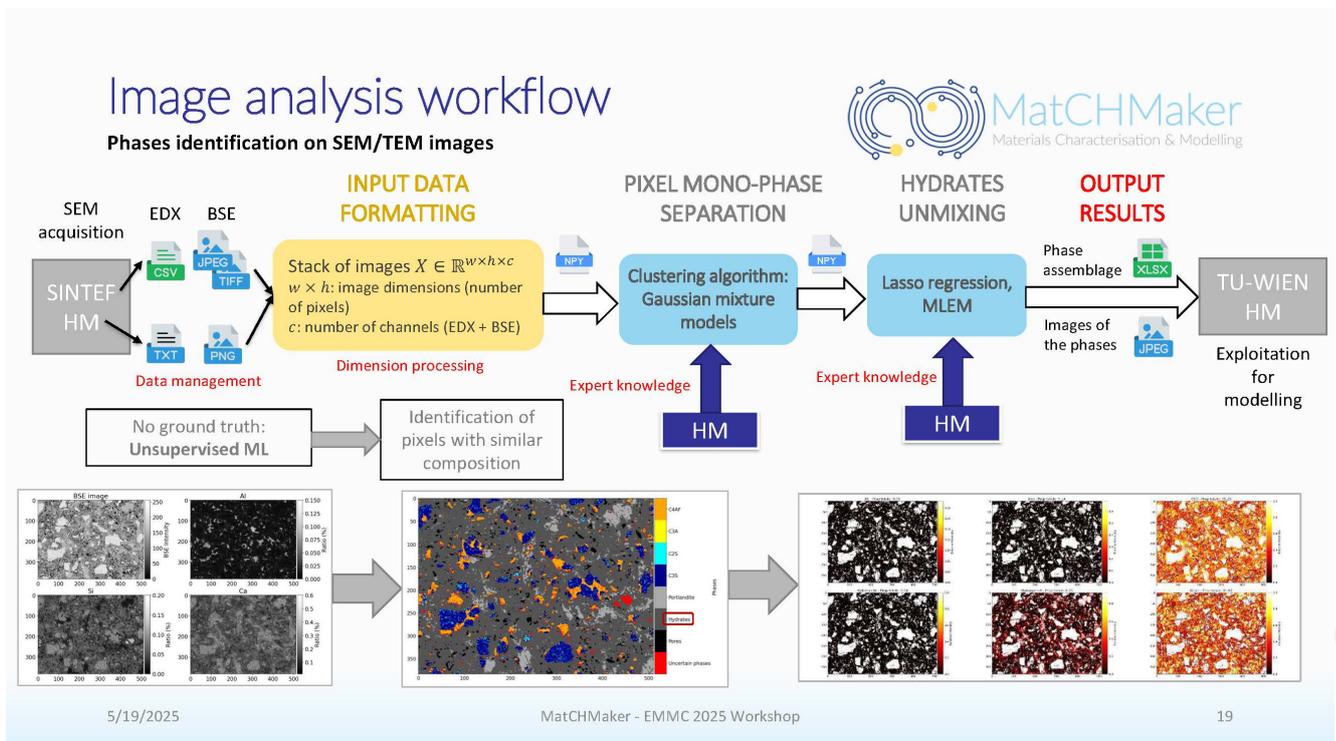

Figure: Image analysis workflow
Source: G. Daniel (CEA) et al. "Characterization and modelling data worfklows for low carbon cement optimization", EMMC 2025

MatCHMaker Open Repository: Making Materials Research More Open and Connected

The MatCHMaker project has reached an exciting milestone with the launch of the first version of its Open Repository, a key development led by SIMAVI. This new online platform aims to make materials research more open, collaborative, and efficient by enabling the sharing of data, tools, and knowledge across teams and borders. In essence, the MatCHMaker Open Repository is a secure digital hub where research data can be stored, searched, and reused. By connecting information from diverse sources, it helps researchers find, interpret, and build upon existing knowledge, fostering collaboration across organisations and countries. Special emphasis is placed on materials research, including the modelling, characterisation, and sustainability assessment of materials.

Designed with usability in mind, the platform provides easy web access for exploring projects, uploading and managing data, and working collaboratively with peers. Behind the interface, modern, reliable technologies ensure that data is handled safely, well-organised, and scalable to meet future needs.

This first release marks a solid foundation for ongoing development, with further updates planned as the project progresses. Lead by SIMAVI, the MatCHMaker Open Repository showcases how advanced digital infrastructures can empower open, connected, and sustainable research, in Europe and beyond.
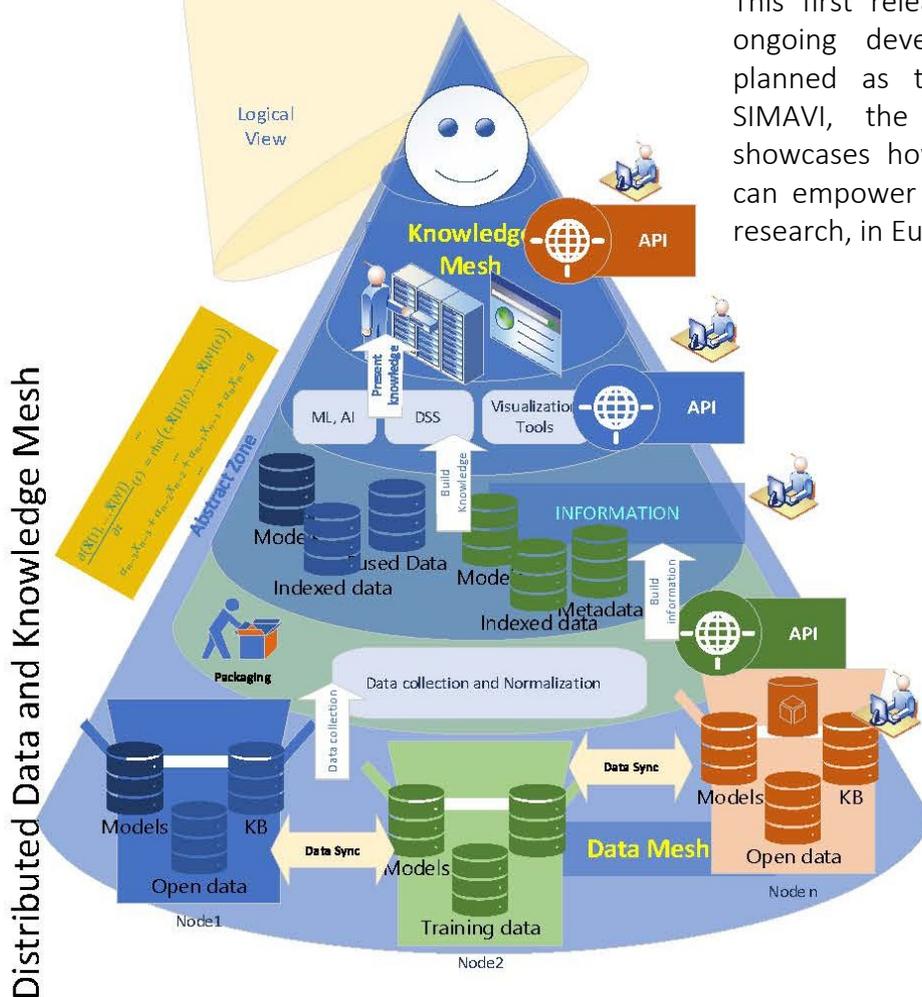

Figure: Logical View
Source: I. Crucianu (SIMAVI) et al., Deliverable D5.2, MatCHMaker Project, 2025

Spotlight on our Partner: GENVIA

High-temperature electrolysis is emerging as one of the most promising ways to reduce industrial emissions, and GENVIA is leading the way in turning this potential into reality. In this interview, **Patrice Tochon** (GENVIA) explains how solid oxide electrolysis cells (SOECs) can dramatically improve efficiency, opening up new opportunities for clean hydrogen production. He explains how GENVIA and the MatCHMaker project are tackling one of the biggest challenges facing SOEC technology: extending cell lifetime under extreme industrial conditions. From uncovering key degradation mechanisms to defining optimal operating strategies, their work is pushing the boundaries of what high-temperature electrolysers can achieve.

Photo: Patrice Tochon (GENVIA)
Director of Research and Strategy
via LinkedIn

Watch here

GENVIA is a clean hydrogen technology venture created to enable individual organizations, industries and nations to meet their goals for decarbonisation by accelerating affordable clean hydrogen production, energy storage and fuel applications at scale.

The company represents a unique combination of French science and global engineering, and benefits from the strength of a group of partner companies that include the French Alternative Energies and Atomic Energy Commission (CEA), SLB, VINCI Construction, Vicat Group and the Occitanie Region.

Use Case II Energy

Emission-free hydrogen production with the highest efficiency

To advance hydrogen production without CO2 emissions, electrolyser technologies could meet the demands in various capacities. The goal will be to produce more hydrogen while consuming less electricity which not only reduces the running costs but also the capital expenditure to install the necessary renewable production capacity. Towards this goal, MatCHMaker aims to improve the performance and mechanical robustness of electrochemical cells implemented in Solid Oxide Electrolysis Cells (SOEC) via advanced modelling and characterisation.
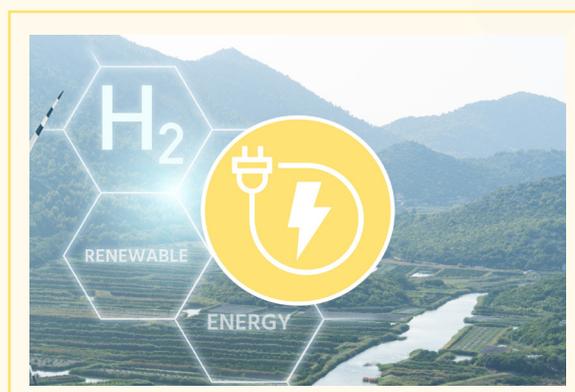
Spotlight on our Partner: CEA (France)

In this interview, **Sylvain Fournier**, research scientist at CEA-LITEN, shares insights into his role and the team's approach to decoding complex material behaviour. He explains how combining rigorous experimentation with data-driven analysis leads to more reliable models, and why interdisciplinary collaboration is key to scientific success. Through concrete examples, he shows how the tools developed are already helping researchers better analyse and understand materials.
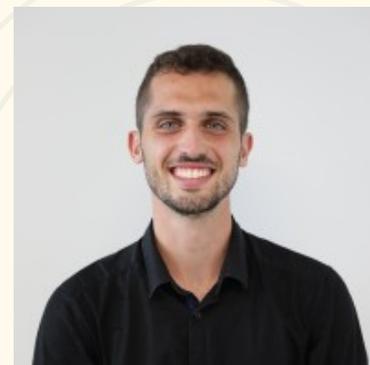

Watch here

Photo: Sylvain Fournier (CEA-LITEN)
Research Scientist
via LinkedIn

The French Alternative Energies and Atomic Energy Commission (CEA) is a key player in research, development and innovation in the areas of low-carbon energies, technological research for industry, fundamental research in the physical sciences and life sciences, and defense and security. In each of these fields, the CEA maintains a cross-disciplinary culture of engineers and researchers, building on the synergies between fundamental and technological research. CEA is the Coordinator of the MatCHMaker project.

Publications

Enhanced phase segmentation of scanning electron microscopy images using U-Net with energy dispersive X-ray spectroscopy-guided labelling
https://doi.org/10.1016/j.matdes.2025.115200

As part of the MatCHMaker Horizon Europe project, a recent publication by **Kassem Dia** (CEA-LITEN) et al. highlight recent progress in applying deep learning to materials characterisation.

The paper presents a U-Net-based workflow for fast, accurate, and fully automated phase segmentation of scanning electron microscopy (SEM) images of Solid Oxide Cells (SOC), using energy-dispersive X-ray spectroscopy-guided labelling during training. By enabling reliable phase segmentation directly from SEM images without requiring additional EDS information at inference time, this approach opens up efficient new possibilities for microstructural analysis.

This work marks an important step forward for data-driven microscopy and offers valuable insights into the pioneering research carried out within the MatCHMaker project.

Report on MatCHMaker Workshop with EMMC and Sister Projects on Data Life Cycles
https://doi.org/10.5281/zenodo.16992583

The MatCHMaker Workshop, organised with the European Materials Modelling Council (EMMC) and featuring Horizon Europe projects like AddMorePower, AID4GREENEST, CoBRAIN, KNOWSKITE-X, and D-STANDART, has resulted in a new White Paper, now published on Zenodo.

It summarises key findings on improving data life cycles in materials modelling and characterisation, offering best practices and recommendations for planning, analysing, preserving, and sharing data across diverse techniques and stakeholders.

Photo: Cherry Edwards-Marois (TU Wien)
MatCHMaker Workshop with the sister projects, April 2025

Event Highlights

4th General Assembly in Vienna
Vienna, Austria
24-25.09.2025
Website: https://he-matchmaker.eu/news/fourth-general-assembly-in-vienna/

The fourth General Assembly of the MatCHMaker project was held on 24-25 September at Technische Universität Wien in Vienna, bringing together consortium partners from across Europe. Marking the project's halfway point, the meeting focused on reviewing progress and discussing next steps through technical sessions. Participants also visited TU Wien's Laboratory for Mechanics of Materials (MMLab).

Photo: Raphael Sperger (TU Wien) *MatCHMaker General Assembly, September 2025*

ESMC 2025 and SOFC-XIX
Lyon, France and Stockholm, Sweden
July 2025
Website: https://esmc2025.sciencesconf.org/,
https://www.electrochem.org/sofc-xix

Project team member **Sylvain Fournier** (CEA-LITEN) presented his postdoctoral research carried out within the MatCHMaker project this year at both the European Solid Mechanics Conference in Lyon and the International Symposium on Solid Oxide Fuel Cells in Stockholm. His work focuses on development, validation, and application of a Phase Field model to describe nickel reoxidation in complex Solid Oxide Cell microstructures and its role in inducing zirconia cracking.

Photo: Sylvain Fournier (CEA-LITEN) via LinkedIn

MatCHMaker at EUROMAT2025
Granada, Spain
September 2025
Website: https://euromat2025.com/

At the 18th European Congress and Exhibition on Advanced Materials and Processes, **Vanessa Alvear** (AIMEN) presented selected results from the MatCHMaker project under the title "Integrating AI and Image Processing for Microstructural Analysis and Strength Forecasting in Cement-Based Materials." **Jesper Friis** (SINTEF) also contributed with a presentation on the digital representation of physical metallurgical knowledge.

Photo by *AIMEN Centro Tecnólogico*
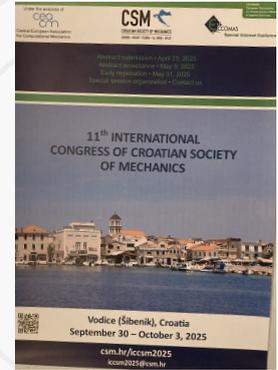Vanessa Alvear (AIMEN)

Photo: Jesper Friis (SINTEF)

ICCSM 2025

Vodice, Croatia
October 2025
Website: https://csm.hr/iccsm2025/

At the International Congress of Croatian Society of Mechanics in Vodice, project team member **Sophie Schmid** (TU Wien) presented recent research from the MatCHMaker project, offering valuable insights into the early-age creep behaviour and strength development of low-carbon cement pastes. The presentation, which also addressed multiscale strength modelling, showcased MatCHMaker's contribution to advancing sustainbale and innovative cement-based materials within the mechanics research community.

Blickpunktfoschung 2025

Vienna, Austria
October 2025
Website: https://www.tuwien.at/forschung/events/externe-veranstaltungen/blickpunkt-forschung/2025-nachhaltige-materialien-und-werkstoffe

Bernhard Pichler (TU Wien) presented recent advances from the MatCHMaker project on the strength development and modelling of cement pastes incorporating supplementary cementitous materials. His presentation highlighted how fundamental research is being transformed into practical approaches that support more sustainbale and future-ready construction materials.

Synergies

Strengthening Synergies through the AiMPACT Cluster

MatCHMaker is proud to be a member of the AiMPACT Cluster, a Horizon Europe alliance dedicated to advancing materials modelling and characterisation in support of a more sustainable, digital, and high-performance future. Through this collaboration, MatCHMaker joins forces with like-mided projects to accelerate innovation and strengthen the link between scientific excellence and industrial impact.

Logo © AiMPACT

Following the publication of the AiMPACT Cluster's official logo and poster, a short animated explainer video was released to further showcase the cluster's shared vision. The video highlights how joint actions and sysnergies across projects can amplify research outcomes and support Europe's transition towards greener and more resilient materials solutions.

In addition to MatCHMaker, the AiMPACT Cluster brings together the projects AddMorePower, AID4GREENEST, CoBRAIN, D-STANDART, and KNOWSKITE-X, all supported by European Union's Horizon research and innovation programme.

Watch the video here

Project Milestone: 3rd Anniversary

Last month, the MatCHMaker project marks its third anniversary. Thanks to the dedication of our team and the support of our partners, the project has fostered collaboration across European materials modelling initiatives, advanced best practices in data management, and achieved outcomes that benefit both research and the wider community. We look forward to building on this foundation in the years ahead.

Hear directly from our project partners as they describe the project in one word and share their perspectives.

Watch now

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