An experimentally-validated multi-scale materials, process and device modelling & design platform enabling non-expert access to open innovation in the Organic and Large Area Electronics Industry (MUSICODE)

Grand Agreement: 953187

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Deliverable 5.2

Cooperation with other EC Projects, Clusters, Networks

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Publishable summary

This document reports the work carried out in the Task 5.4 “Cooperation with EC Councils (EMMC, EMMO, etc) and EC Projects (M1-M48)” under the WP5 “Cooperation with EU stakeholders for population of the workflows (M1-M48)”. WP5 develops the cooperation strategy and framework to enable harmonized connectivity to other Marketplaces, HPCs, OTE, BDSSs, OIEs, other DBs, etc., and EMMC/EMMO on ontology. Deliverable 5.2 focusses on Networking with European Clusters and Councils, through participation in meetings and workshops, organization of common events and preparation of guidance documents for the materials modelling for manufacturing. These include the following: EMCC (AUTh participates in WG1 Instrumentation & Metrology), EMMC (ANSYS participates as a partner). Of high importance is the clustering and setup of common activities with the other two Open Innovation Platform (OIP) H2020 Projects (VIPCOAT and OpenModel). Moreover, connection with other OIE H2020 Projects is targeted, in which the partners coordinate and participate, as well as connection with OITB H2020 Projects and the new projects to be funded by EC in the years 2010-2023 is aimed.

1. Introduction

This document reports the work carried out in Task 5.4 “Cooperation with EC Councils (EMMC, EMMO, etc) and EC Projects (M1-M48)” under the WP5 “Cooperation with EU stakeholders for population of the workflows (M1-M48)”. WP5 performs the development of the cooperation strategy and framework to enable harmonized connectivity to other Marketplaces, HPCs, OTE, BDSSs, OIEs, other DBs etc. EMMC/EMMO on ontology. Deliverable 5.2 focusses in the period M1-M24 on Networking with European Clusters and Councils, through participation in meetings and workshops, organization of common events, preparation of guidance documents for the materials modelling for manufacturing.

This report provides an overview of the MUSICODE activities (M1-M24) regarding the networking activities with EC Projects, Clusters and Councils, Networks and Associations to promote the benefits of Open Innovation Platforms for Materials Modelling for the European Industry, to promote inter-project collaboration, as well as to promote the adoption of MUSICODE’s new modelling technology and multiscale extensions that are necessary to improve the modelling capabilities of solar cells and OLEDs.

2. Tools for Clustering Activities

Synergic activities are essential to support, improve and disseminate innovation and eventually maximize its uptake by industry. In this framework, MUSICODE emphasizes on cooperating with other relevant European projects, clusters, networks, and initiatives to increase dissemination, enhance communication channels, and achieve effective promotion of MUSICODE results to relevant stakeholders globally.

The main MUSICODE objective is to develop a novel **Open Innovation Materials Modelling Platform to enable the Organic and Large Area Electronics Industry** (OLAE) to accelerate precise and knowledgeable business decisions on materials design and processing to optimize the efficiency and quality of OLAE device manufacturing. To achieve and maximize the desired impact of the project, a clear and aggressive clustering strategy is needed which will to help increase the involvement of interested industrial stakeholders and accelerate the industrial uptake and exploitation of project innovations. To this end, MUSICODE has expanded its activities in 3 fronts: (a) created a strong cluster with the other 2 Open Innovation Platform (OIP) projects (VIPCOAT and OpenModel) and organized common activities, (b) participated in numerous workshops organized by EMMC and other EC projects, (c) organized and participated in international evens (conferences, expos, etc).Through these activities, MUSICODE has established communication channels connections with European networks, clusters and councils as well as industrial associations. Moreover, there has been significant utilization of public media such as the MUSICODE's website, social media accounts, Newsletters and Press Releases towards facilitating and promoting the communication and clustering activities.

Overall, project members participated in various international events (conferences, exhibitions, etc.) within the period M1-M24, that brought together EU clusters and councils, networks, and industrial associations, as well as other stakeholders involved in the field of Organic Electronics. While most of these events were precursors for collaborations and clustering with industrial, academic and research communities, the detailed list of presentations at international scientific conferences, workshops and exhibitions are not described here, but in the deliverable D7.2 "Intermediate Report on Dissemination and Communication".

3. Clustering with OIP Projects

3.1 OIP cluster objectives

A strong effort was dedicated from early on to create and establish an active cluster with the other two EC projects funded under the same call on "Open Innovation Platforms for Materials Modelling", namely the VIPCOAT and OpenModel projects. Several meetings and workshops have been organized between the projects and with other stakeholder groups. The objectives of the **Open Innovation Platform (OIP) cluster**, as they have been formulated and decided in a series of meeting and workshops, are:

1. Create ties with industry and promote the ideas and tools developed and offered by the OIPs
2. Contribute to the discussion and vision of an EU/EMMC roadmap for OIP and materials modelling
3. Enhance the impact and sustainability of OIPs by creating common collaborative projects
4. Exchange information and assure coherence of the EU research by avoiding replication of work

The three EC projects comprising the OIP cluster are shown in Table 1.

Table 1. The OIP cluster projects

MUSICODE	An experimentally-validated multi-scale materials, process and device modeling & design platform enabling non-expert access to open innovation in the organic and large area electronics industry	musicode.eu
VIPcoat	Virtual Open Innovation Platform for Active Protective Coatings Guided by Modelling and Optimization	vipcoat-oip.com
OpenModel	Integrated Open Access Materials Modelling Innovation Platform for Europe	open-model.eu

3.2 OIP cluster meetings

Two online telcos between the coordinators and managers of the three projects were initially held to create a first list of objectives for our new collaboration and of the newly established OIP cluster. These were on:

- Friday, 7 May 2021, 14.30-15.30 CET
- Thursday, 27 May 2021, 15.00-16.00 CET

These discussions resulted in the organization of a first OIP workshop in July 2021 within the context of the Nanotexnology 2021 conference in Thessaloniki and a OIP cooperation workshop in September 2021 in Brussels.

The first OIP workshop was organized (by the MUSICODE project) within the ISFOE21 (International Symposium for Flexible and Organic Electronics) of the Nanotexnology Conference in Thessaloniki on Thursday, 8 July 2021. In Fig. 1a is the poster for ISFOE21, showing several OIP related workshops organized and supported by MUSICODE and the OIP cluster, namely: (a) Computational Modelling of Materials & Devices, (b) Special workshop on EU-funded Projects, (c) Open Innovation and Standardization. In Fig.1b is a photo of the MUSICODE Expo booth in the same conference. In Fig. 2 is detailed program of the Workshop on Open Innovation and Standardization, held on Thursday, 8 July, which included talks by many experts and related EU projects in the field, notably by N. Adamovic of TU Wien and EMMC, M. Münzberg of Universität Potsdam, J. Fahlteich of Fraunhofer FEP, J. Gavillet of Grenoble, M. Sebastiani of Università degli studi “Roma Tre”, along with talks given by the three OIP coordinators.

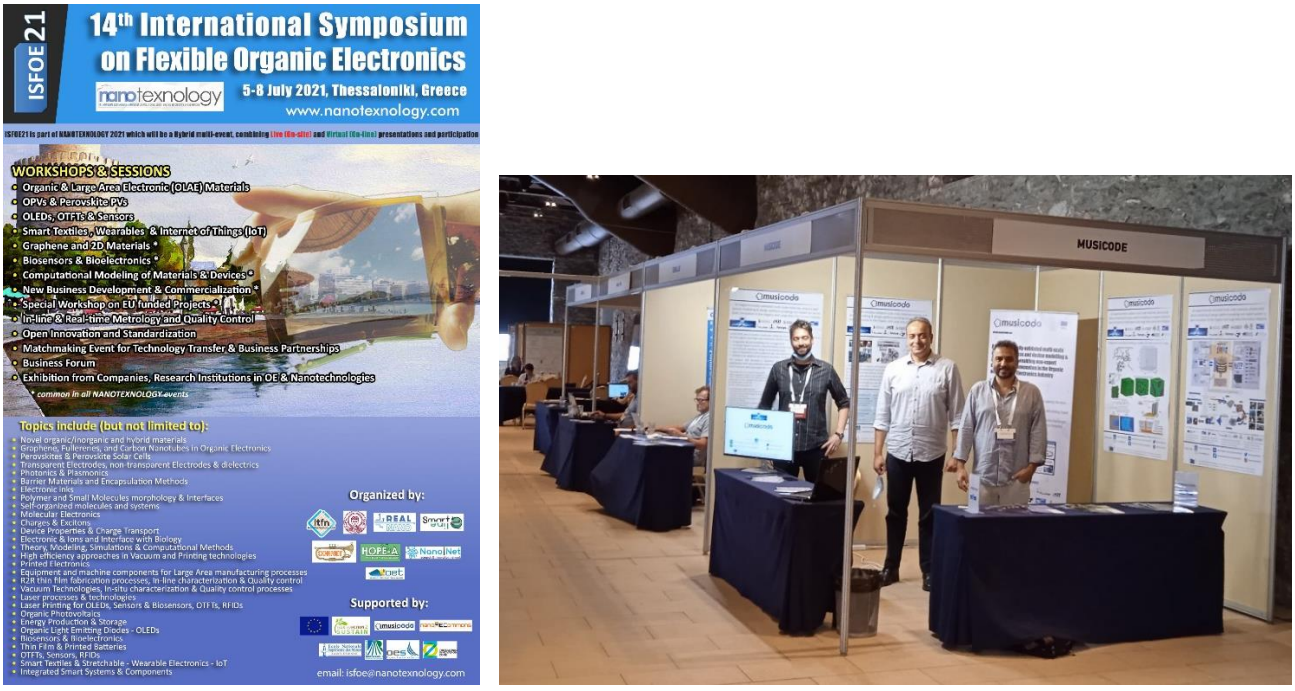


Figure 1. (a, left) The ISFOE21 poster with OIP-cluster supported workshops. (b, right) the MUSICODE Expo booth in the Nanotexnology21 conference.

11:00-13:00	**Open Innovation, Standardization & Business Development 1 (V:ISFOE2, L:TIMBER2)** Chair: A. Laskarakis, LTFN, AUTh, Greece
11:00-11:30 INVITED	**Research and Innovation in Nanotechnologies for the next Programming Period 2021 - 2027** **A. Chatziparadeisis** *Consultant, Former Director In General Secretariat of Research and Innovation, Greece*
11:30-12:00 INVITED	**Presentation of the Horizon Europe Work Programme 2021-2022 for the Cluster "Digital, Industry & Space"** **M. Chachamidou** National Delegate in Cluster "Digital, Industry & Space" of Horizon Europe
12:00-12:15	**In-line and Real-time Nano-characterization technologies for the high yield manufacturing of Flexible Organic Electronics** **C. Kapnopoulos** *Nanotechnology Lab LTFN, Aristotle University of Thessaloniki, Greece*
12:15-12:30	**NANOPAT: Process Analytical Technologies for Industrial Nanoparticle Production** **M. Münzberg** Institute of Chemistry, Universität Potsdam, Germany
12:30-1245 PROJECT	**Open Innovation Ecosystem for Sustainable NanoFunctionalized Flexible Surfaces/H2020 FF2S** J. Fahlteich *Fraunhofer FEP, Germany*
12:45-13:00 PROJECT	**SmatEEs2: A Digital Innovation Hub on Flexible & Wearable Electronics** **J. Gavillet** CEA-Liten, Grenoble, France

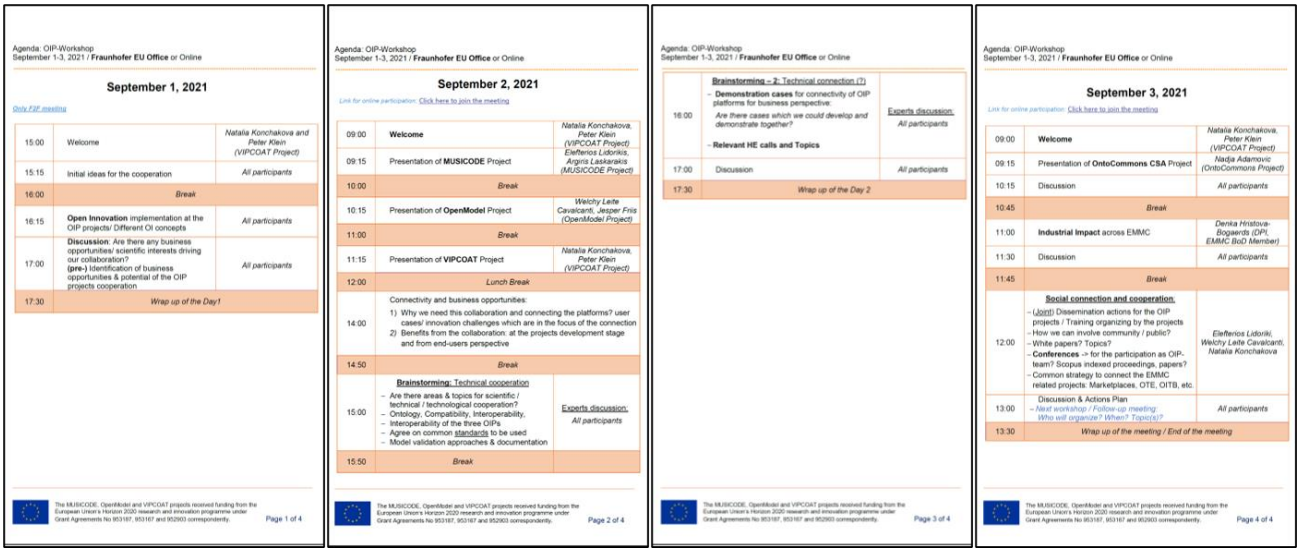
14:00-16:00	**Open Innovation, Standardization & Business Development 2 (V:ISFOE2, L:CRYSTAL)** **Chair:** E. Lidorikis, University of Ioannina, Greece
14:00-14:30 INVITED PROJECT	**OntoCommons.eu: Ontology-driven data documentation for Industry Commons** **N. Adamovic**[1], H. Karray[2] *[1] TU Wien, Institute of Sensor and Actuator Systems (ISAS), Vienna, Austria, [2] Ecole Nationale d'Ingenieurs de Tarbes (ENIT), France*
14:30-15:00 INVITED	**Integration of material modelling with business decision support systems** C. Kavka *Research and Development Department, ESTECO SpA Area Science Park, Trieste, Italy*
15:00-15:30 INVITED PROJECT	**H2020 OYSTER - novel metadata structures for advanced materials characterisation** **M. Sebastiani** *Università degli studi "Roma Tre", Engineering Department, Rome Italy*
15:30-15:45 PROJECT	**Linked CHADA and MODA for GHz characterisation and modelling of energy materials in the H2020 NanoBat project** M. Celuch, M. Olszewska-Placha *QWED Sp. z o.o., ul. Krzywickiego 12 lok.1, Warsaw, Poland*
15:45-16:00 PROJECT	**Multiscale modelling and characterization to optimize the manufacturing processes of Organic Electronics materials and devices (CORNET)** M. Kanta *HOPE-A, Greece*

16:30-18:00	**Open Innovation, Standardization & Business Development 3 (V:ISFOE2, L:CRYSTAL)** **Chair:** A. Laskarakis, LTFN, AUTh, Greece
16:30-17:00 INVITED PROJECT	**An experimentally-validated multi-scale materials, process and device modeling & design platform enabling non-expert access to open innovation in the organic and large area electronics industry** **E. Lidorikis** *University of Ioannina, Greece*
17:00-17:30 INVITED PROJECT	**Quadruple Helix Innovation Model for modelling supported design of green protective coatings (H2020 VIPCOAT)** **N. Konchakova**[1], P. Klein[2] *[1] Institute of Surface Science, Helmholtz-Zentrum Hereon, Max-Planck-Straße 1, D-21502 Geesthacht, Germany* *[2] Fraunhofer Institute for Industrial Mathematics, Fraunhofer-Platz 1, D-67663 Kaiserslautern, Germany*
17:30-18:00 INVITED PROJECT	**VIMMP - VIRTUAL MATERIALS MARKETPLACE** **Welchy Leite Cavalcanti** *Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Wiener Strasse 12 – 28359 Bremen, Germany*

Figure 2. The program of the workshop on "Open Innovation and Standardization" co-organized by the 3 OIP projects, constituting part of the 1st OIP meeting.

The next OIP cooperation workshop was organized (by the VIPCOAT project) in 1-3 September 2021 in Brussels (Fraunhofer EU Office 94, Rue Royale (Philanthropy House) 1000 Brussels, Belgium). Due to COVID-19 restrictions, the meeting was hybrid, with both live and online participants. The invitation, agenda, and screen shot of some of the participants in that meeting are shown in Fig. 3.

Figure 3a. The invitation front page for the OIP meeting on 1-3 September 2021.



Agenda: OIP-Workshop
September 1-3, 2021 / **Fraunhofer EU Office** or Online

September 1, 2021

Only F2F meeting

15:00	Welcome	*Natalia Konchakova and Peter Klein (VIPCOAT Project)*
15:15	Initial ideas for the cooperation	*All participants*
16:00	*Break*	
16:15	**Open Innovation** implementation at the OIP projects/ Different OI concepts	*All participants*
17:00	**Discussion**: Are there any business opportunities/ scientific interests driving our collaboration? **(pre-)** Identification of business opportunities & potential of the OIP projects cooperation	*All participants*
17:30	*Wrap up of the Day1*	

The MUSICODE, OpenModel and VIPCOAT projects received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreements No 953187, 953167 and 952903 correspondently. Page 1 of 4

Agenda: OIP-Workshop
September 1-3, 2021 / **Fraunhofer EU Office** or Online

September 2, 2021

Link for online participation: Click here to join the meeting

09:00	**Welcome**	*Natalia Konchakova, Peter Klein (VIPCOAT Project)*
09:15	Presentation of **MUSICODE** Project	*Eleftherios Lidorikis, Argiris Laskarakis (MUSICODE Project)*
10:00	*Break*	
10:15	Presentation of **OpenModel** Project	*Welchy Leite Cavalcanti, Jesper Friis (OpenModel Project)*
11:00	*Break*	
11:15	Presentation of **VIPCOAT** Project	*Natalia Konchakova, Peter Klein (VIPCOAT Project)*
12:00	*Lunch Break*	
14:00	Connectivity and business opportunities: 1) Why we need this collaboration and connecting the platforms? user cases/ innovation challenges which are in the focus of the connection 2) Benefits from the collaboration: at the projects development stage and from end-users perspective	
14:50	*Break*	
15:00	**Brainstorming**: Technical cooperation – Are there areas & topics for scientific / technical / technological cooperation? – Ontology, Compatibility, Interoperability, – Interoperability of the three OIPs – Agree on common standards to be used – Model validation approaches & documentation	Experts discussion: *All participants*
15:50	*Break*	

The MUSICODE, OpenModel and VIPCOAT projects received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreements No 953187, 953167 and 952903 correspondently. Page 2 of 4

Agenda: OIP-Workshop
September 1-3, 2021 / **Fraunhofer EU Office** or Online

16:00	**Brainstorming – 2:** Technical connection (?) – **Demonstration cases** for connectivity of OIP platforms for business perspective: *Are there cases which we could develop and demonstrate together?* – **Relevant HE calls and Topics**	Experts discussion: *All participants*
17:00	Discussion	*All participants*
17:30	*Wrap up of the Day 2*	

The MUSICODE, OpenModel and VIPCOAT projects received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreements No 953187, 953167 and 952903 correspondently. Page 3 of 4

Agenda: OIP-Workshop
September 1-3, 2021 / **Fraunhofer EU Office** or Online

September 3, 2021

Link for online participation: Click here to join the meeting

09:00	**Welcome**	*Natalia Konchakova, Peter Klein (VIPCOAT Project)*
09:15	Presentation of **OntoCommons CSA** Project	*Nadja Adamovic (OntoCommons Project)*
10:15	Discussion	*All participants*
10:45	*Break*	
11:00	**Industrial Impact** across EMMC	*Denka Hristova-Bogaerds (DPI, EMMC BoD Member)*
11:30	Discussion	*All participants*
11:45	*Break*	
12:00	**Social connection and cooperation:** – (Joint) Dissemination actions for the OIP projects / Training organizing by the projects – How we can involve community / public? – White papers? Topics? – **Conferences** -> for the participation as OIP-team? Scopus indexed proceedings, papers? – Common strategy to connect the EMMC related projects: Marketplaces, OTE, OITB, etc.	*Eleftherios Lidorikis, Welchy Leite Cavalcanti, Natalia Konchakova*
13:00	Discussion & Actions Plan – *Next workshop / Follow-up meeting: Who will organize? When? Topic(s)?*	*All participants*
13:30	*Wrap up of the meeting / End of the meeting*	

The MUSICODE, OpenModel and VIPCOAT projects received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreements No 953187, 953167 and 952903 correspondently. Page 4 of 4

Figure 3b. The agenda for the OIP meeting on 1-3 September 2021.

Figure 3c: Photo of the participants at OIP Meeting at 1-3rd of September 2021

In preparing for the OIP meeting from the MUSICODE side, the coordinator put together a list of discussion points/open questions to the MUSICODE partners and compiled all input/thoughts received from them. This is interesting in its own merit and is presented below:

1. What does it mean "Open Innovation Platform?" Are there features, beyond what we envision for MUSICODE, that we could use/benefit from other OIPs? Could there be a "global" target that the 3 OIP projects could collaborate on?

- We should try to agree on a shared definition of "Open Innovation" within the context of materials modelling.
- What is the subject of the innovation? Materials? Models? Materials Modelling Platforms?
- Open –means extensible, so that any stakeholder can plug-in its tools, workflows, data, etc. Open in sense of open-source licensing is not required but may be an advantage.
- "Open Innovation Platform" to me means that the platform provides ways to extend it by connecting to it other tools, be them visualization tools, a BDSS or another OIP. So open to extensions/integration.

2. Can/should we design our platforms towards inter-compatibility? What do we mean by platform compatibility? E.g., common rules for connecting to Marketplaces? Or even further towards model interoperability? Is it possible/desirable?

- What does it mean is the good question? I do not think is a good or realistic idea to design the platform based on other projects. Each project has its own plans, deliverables and objectives which are already quite ambitious (I guess) I do not see the need to add additional constraints.

- An alternative option is to enable a platform to use resources/features of another platform.
- Marketplaces are a different discussion. First the "common rules" should/will be dictated by these platforms, here few questions arise:
    - What exactly are these marketplaces? There are two projects running, for neither of them doesn't sees there are public information on how to connect to them.
    - Are there plans for continuation maintenance of these projects? Will any of these be there in 2-3-4 years?
    - Are there other marketplaces?
- Model interoperability I am not sure what means. If refers to ability to mix and match workflows or part of workflows, this seems to me too ambitious and too early to be discussed.
- Marketplaces should allow integration of any simulation platform and execution of its simulation workflows. This would require, in my opinion, to have at least well documented marketplace API (generic, for workflows and data, abstracting different platforms, data sources and formats). Ontological, semantic based approach can help here. But in my opinion, supporting multiple data formats requires service-like data API, like what we have in MuPIF and this needs to be reflected in ontology. On lower levels, the way how to structure data is more-less clear (grains-molecules-atoms etc) but on microstructure and continuum levels, different ways how to structure and organize data exists.
- Platform compatibility: can certainly exists at different levels, starting from compatibility at data level (either syntactic or semantic), compatibility of model APIs, and finally at meta-platform level (marketplace), potentially integrating data and services from individual platforms.
- We could have data compatibility, in the sense that data present in/produced by an OIP can be consumed/used in another OIP.
- With data compatibility in place, we could think of having interoperability at the modeling workflow execution level, with one OIP requesting the execution of a modeling workflow in another OIP, to then use the results of such execution.

3. Is it beneficial to establish a common ontology? Or it may become a serious roadblock if there is inefficient collaboration? When is the best time to start discussing our ontologies?

- Collaborating on ontologies is fine, but it can easily increase significantly amount of work and if taken to strict, can become a roadblock. The risks are that either we have long discussion on every entity on the ontologies slowing down the project or the ontologies will diverge till the point that will be practically impossible to realign them. My suggestion will be to align and collaborate on a subset of well-defined common domains, E.g., molecules ontology, by forming cross-projects EMMC task groups within the interoperability focus area.
- Ontology is beneficial, not sure what domains individual projects cover and if there is/can be an overlap. In my opinion the individual projects have their goals they need to fulfil, and this is of the primary importance for them, the common ontology can be valuable result, but should not block the projects from reaching their goals. The best time to start discussions is as soon as possible, ontology defines to some extend how data is structured and this needs to be defined in every project at the very beginning.
- A common ontology could help in obtaining these kinds of compatibility.

4. Are the any scientific & technological advantages we expect from the collaboration?

- Difficult to say if unclear what is the collaboration about and even what the project approach/use cases/goals are. Perhaps something summarizing these points and overlaps could be a first good outcome of the workshop.

5. Creation of common standards for model validation seems promising: approaches, methods, documentations. Ideas/comments?

- There will be the need to validate workflows more than models and it is very case dependent. Are there overlapping/common workflows among the projects?
- For validation one would need reference solutions and data (e.g., experimental) this could be curated in common datasets. Collaborations could make datasets more comprehensive and therefore reusable.
- Uncertainty Quantification could also be an area of collaboration.
- At least at continuum level, there exist a NAFEMS organization, which defines number of benchmark problems for FE, that can be used for validation.

6. Can new business opportunities emerge if the different platforms are compatible?

- Perhaps. What are the business plans of the OIP projects?
- In my opinion this is primarily important for users, the portfolio of available models and data sources is simply much richer. For vendors, the fact that they need to maintain only single, compatible, API is also an important benefit.

7. Can common dissemination actions empower our position (EMMC, Horizon Europe, etc)? E.g., training workshops, conferences, white papers, papers. Other ideas?

- Common dissemination, such as training workshops, conferences, and white papers, makes sense for common activities and approaches. Before we should identify those. Presentation within EMMC (e.g., webinars, workshops) to show progresses and approaches will be good to have. This could even evolve into a focus area for Open Innovation Platforms.

In the first day of the meeting, the different ideas and concepts surrounding Open Innovation were discussed between the participants of the 3 OIP projects. The second day of the meeting had project presentations followed to discussion and brainstorming regarding cooperation, both from the business point of view as well as from the technical point of view.

From the business point of view, a common approach towards the market was discussed, i.e., by creating a common platform/marketplace to market the 3 individual OIPs (a similar but alternate idea was to go towards the marker through the "Marketplace Association", a possible spinoff from the Marketplace project).

From the technical point of view, clear collaboration points were defined:

- Ontology development
- Interoperability (platforms, models, data)
- Common approach towards Marketplace integration
- Establishment of common standards
- Joint publications/white papers
- Decide on a common demonstrator

In the last day of the meeting two interesting and relevant invited talks were presented:

- Nadja Adamovic (OntoCommons Project): Presentation of OntoCommons CSA Project
- Denka Hristova-Bogaerds (DPI, EMMC BoD Member): Industrial Impact across EMMC

Finally, from a policy point of view, there was a discussion of what Open Innovation Platforms mean, how they can facilitate innovation in Europe, how they fit within the other research and innovation activities in Europe, and what is/should be their place in the future EU research program and calls. As a result of this discussion, the 3 OIP projects were invited to assemble their ideas/suggestions in a white paper, which is now published in ZENODO (https://zenodo.org/record/5848552), to be presented in more detail in the next session.

The next meeting was organized (by the OpenModel project) online on the 17th of February 2022. The meeting agenda is shown in Fig. 4a, while a screenshot with participants is shown in Fig. 4b.

2022-12-27

COOPERATION WORKSHOP

17.02.2022

AGENDA

COOPERATION WORKSHOP: MEETING WITH OIP PROJECTS

THURSDAY 17.02.2022 / LINK TO CONNECT:

09:45 – 10:00: Connecting

10:00 – Welcome Greetings and Introduction (OIP projects coordinators)

10:10 – 10:20: Overview and Goals - OpenModel coordination - Welchy Leite Cavalcanti/IFAM and Jesper Friis/Sintef)

10:20 – 10:50: VIMMP project (Welchy Leite Cavalcanti/IFAM, Rafael Mumdin/OSTHUS)

10:50 – 11:20: Coffee Break

11:20 – 12:00: ReaxPro project (Sergio Lopez/SCM, Joana Morgado / Fraunhofer IWM)

12:00 – 12:20: Dome4.0 project (Bijan Yadollahi/CMCL)

12:20 – 14:00: Lunch Break

14:00 – 15:30: Overview and advances of the VIPCOAT, MUSICODE and OpenModel projects

- **VIPCOAT (Natalia Konchakova /HEREON, Peter Klein/Fraunhofer ITWM)**
- **MUSICODE (Elefterios Lidorikis/University of Ioannina, Argiris Laskarakis/ Aristotle University of Thessaloniki)**
- **OpenModel (Welchy Leite Cavalcanti/IFAM, Jesper Friis/Sintef)**

15:30 – 16:00: Brainstorming of possibilities of joint work based on current status /next meeting/ next steps

16:00: End of Meeting

The MUSICODE, OpenModel and VIPCOAT projects received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreements No 953187, 953167 and 952903, respectively.

Figure 4a. Agenda of the OIP meeting on the 17 February 2022.

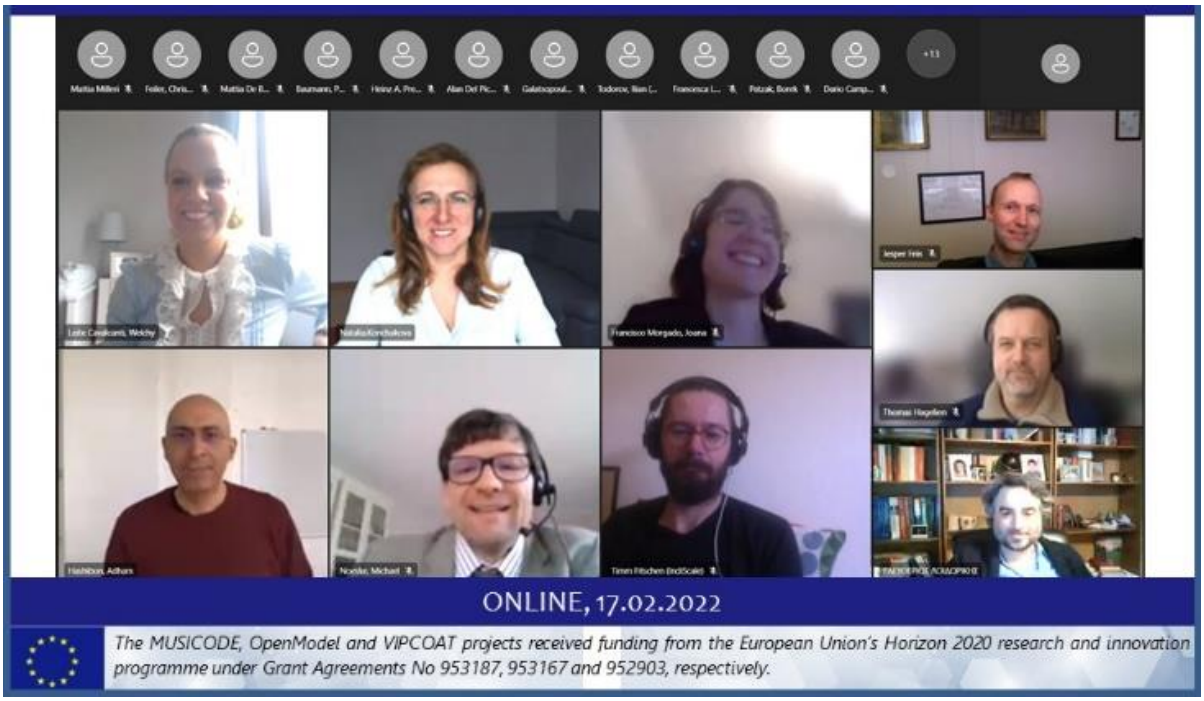


Fig. 4b: Screenshot of the participants at OIP Workshop at 17th of February 2022

A series of invited talks from ongoing marketplace projects were presented, to facilitate the OIP discussion on our approach towards marketplace integration. The projects presented were: VIMMP, ReaxPro and Dome4.0. After the presentation of the 3 OIP projects and of the recent progress made, a mostly technical discussion between all participants was held, focused on data, ontology, interoperability, and marketplace integration. The discussions included the possibilities of developing synergetic activities in the future. A spin-off of these discussions was the creation of an EMMC Task Group for the definition of a common **workflow ontology**. This activity is led by OpenModel, with the first meeting of the Task Group taking place online on 22nd of November 2022.

The next OIP workshop was organized (by the MUSICODE project) within the ISFOE22 of the Nanotexnology Conference in Thessaloniki on Thursday, 8 July 2021. The Special Workshop on Open Innovation was held on Tuesday 5 July 2022, whose agenda is shown in Fig. 5a. This provided the opportunity to discuss several scientific and practical approaches for different questions, including Open Innovation. All 3 H2020 EU projects demonstrated their collaboration providing lectures at the Workshop of Open Innovation and Standardization. Discussions were held between OIP participants during the session and throughout the rest of the conference.

Moreover, the first OIP Expo Booth was organized (in the large exhibition area of the conference), to offer a coherent view of OIP activities and OIP vision in Europe (see Fig. 5b of a photo of the OIP booth) and get the industrial stakeholders involved with the projects' developments, objectives, and future sustainability.

14:30-16:30	**Special Workshop on Open Innovation (Room: Timber Hall 2)** **Chair: E. Lidorikis**
14:30-15:00 INVITED (L)	**Facilitators of Open Innovations – Who are They? A case study in Advanced Protective Coatings** **N. Konchakova1**, P. Klein[2], P. Visser3, K. Schladitz2 *[1] Institute of Surface Science, Helmholtz-Zentrum Hereon, Geesthacht, Germany* *[2] Fraunhofer Institute for Industrial Mathematics, Germany* *[3] Akzo Nobel Car Refinishes B.V., Rijksstraatweg 31, 2171 AJ Sassenheim, The Netherlands*
15:00-15:20 INVITED (L)	**Building an industry-driven "innovation ecosystem" through the establishment of platforms for characterization** **D. Dykeman[1]**, D. DiStefano1, Jean-Marc Lucatelli2, Victor Etique2, Ludovic Steinbach1, Andrea Berto2, Yuan Wren2 *Ansys UK Ltd., [1] Materials Business Unit, [2]Applications Engineering, Cambridge, UK*
15:20-15:40 INVITED (L)	**From MODA to executable workflows via the BPMN standard** **D. Campagna** *Research and Development Department, ESTECO SpA Area Science Park, Trieste, Italy*
15:40-16:00 INVITED (L)	**An experimentally validated multi-scale materials, process and device modeling & design platform enabling non-expert access to open innovation in the organic and large area electronics industry (MUSICODE)** **E. Lidorikis** *University of Ioannina, Greece*
16:00-16:15 INVITED (L)	**An integrated open-access platform for materials modelling innovation: OpenModel** **O. M. Roscioni[1]**, G. Goldbeck[1], F. L. Bleken[2], J. Friis[3], W. Leite Cavalcanti[4] *[1] Goldbeck Consulting Limited, St John's Innovation Centre, Cambridge, UK* *[2] SINTEF Industry, Process Technology, Oslo, Norway* *[3] SINTEF Industry, Materials and Nanotechnology, Trondheim, Norway* *[4] Fraunhofer IFAM, Bremen, Germany*
16:15-16:30 INVITED (L)	**The European Open Innovation Ecosystem: How Open Innovation Test Beds, Open Access Pilot Lines and Digital Innovation Hubs may help European SME** **J. Fahlteich** *KETMarket GmbH, Germany*

Figure 5a. The meeting program for the OIP meeting on 5 July 2022 within the ISFOE22 conference.

Figure 5b: Photo of VIPCOAT's and MUSICODE's partners in the OIP Booth at NANOTEXNOLOGY EXPO22. From left, *representatives of VIPCOAT consortium P. Klein (ITWM) and N. Konchakova (HEREON) with the members of MUSICODE consortium D. Dykeman (ANSYS), E. Lidorikis (UoI) and A. Laskarakis (AUTh)*

Finally, the **latest OIP workshop organized (by the VIPCOAT project) was the "Collaboration Workshop Open Innovation Facilitation in Horizon Europe"**, October 5-6, 2022, in Brussels. The venue was held at the Hanse Office and Representation of the Free Hanseatic City of Bremen in Brussels. The invitation is shown in Fig. 6a. A formal letter was drafted to invite representatives from industry, government, academia, and society. During the two-day workshop, more than 40 participants from industry, government, academia, and society contributed to an interdisciplinary exchange of opinions, requests and new ideas on promotion and development of open innovation processes and supporting tools in the context of new products design based on advanced modeling for materials and environmental sustainability.

The main idea of the **Open Innovation Facilitation in Horizon Europe** workshop was to grasp new ideas and requirements on how to promote and realize open innovation processes and supporting tools to deliver innovations based on **materials design.** To facilitate this, the workshop organized a ***knowledge-cafe*** in the first day, and a ***fish-bowl discussion*** in the second day.

*Fig. 6a: Collaboration Workshop **Open Innovation Facilitation in Horizon Europe***

The knowledge-café was split into 4 different round-table discussions (with participants rotating every 20 minutes), each focused on a specific question relating to Open Innovation, as shown in the meeting agenda in Fig. 6b. Members of the OIP cluster were chairing the different tables. Representative pictures are shown in Fig. 6c. The comments/ideas received during the first day were gathered and summarized the next day, being the starting point of the fish-bowl discussion. Overall, this has been a very useful and fruitful meeting. As next steps, an OIP White paper summarizing the workshop outcomes is in preparation. The work on finishing this OIP White paper is planned to continue into the beginning of 2023.

The MUSICODE partners that participated in this **Open Innovation Facilitation in Horizon Europe** workshop included UoI, ESTECO, ANSYS and AIXTRON.

Additional discussions between MUSICODE partners (UoI and ESTECO) and OpenModel partners (SINTEF) included plans on future collaboration projects, specifically, on creating a common demonstrator on cross-platform interoperability. This can work in two levels, i.e., either the data or the models from one platform being used in the other platform. While such a demonstrator is currently out of the scope of the projects, it is nevertheless a unique opportunity (if successful) to demonstrate a future vision of an interconnected interoperable multi-platform environment transcending multiple application domains. More discussions on this side-project (use-case) will follow in upcoming OIP meeting in 2023.

Agenda / Workshop Structure

October 05

14:00 Introduction of the OIP Projects

MUSICODE (Prof. Elefterios Lidorikis, University of Ioannina, GR)

OpenModel (Dr. Jesper Friis, SINTEF, NO)

VIPCOAT (Dr. Natalia Konchakova, Helmholtz Zentrum Hereon, DE)

14:30 **André van Linden** (AkzoNobel, Director Scientific Academic Partnership)
Open Innovation – Collaboration from Industrial Perspective

14:45 **Dr. Thomas Wobben** (European Committee of the Regions, Director of Directorate C)
New EU Innovation Agenda: Open Innovation and smart specialisation

15:00 Introduction to the Knowledge Cafe (Dr. Peter Klein, Fraunhofer ITWM, DE)

15:10 Coffee Break

15:30 **Knowledge Café** for all participants. Guiding questions

- What does Open Innovation mean for Industry? Which opportunities and industrial needs in Open Innovation do you identify, and which impact do you expect? How can industry contribute to facilitate Open Innovation?
- What are the main academic needs in Open Innovation, and how to address these needs? How can academia contribute to Open Innovation Facilitation?
- How would an ideal Open Innovation process look like? Which tools are necessary to realize such a process?
- What benefits for society, sustainability and protection of environment can Open Innovation generate? Which opportunities and/or barriers can you identify?

17:30 A first collection of ideas (Elefterios Lidorikis, Jesper Friis, Peter Klein, Natalia Konchakova)

18:00 Networking apéro

October 06

09:00 Knowledge Cafe Debriefing (presentation of the results by the "hosts")

09:45 **„Fishbowl"** discussion (moderation by Natalia Konchakova and Peter Klein)

Experts in Open Innovation from all stakeholders groups

Dr. Holger Ihssen *(Helmholtz Association),* ***Dr. Patrick Keil*** *(BASF Coatings GmbH),*
Dr. Gavin Bown *(Beckers Ind. Coatings Ltd),* ***Dr. Franc Mouwen*** *(EC, EIC)*

11:30 **Open Innovation approach applied to the design of Horizon Europe future calls:**
Dr. Francesco Matteucci (European Commission, European Innovation Council)

12:00 Wrap-up and summary & Closing day 2

12:30 Light lunch

The MUSICODE, OpenModel and VIPCOAT projects received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreements No 953187, 953167 and 952903 respectively.

Page 2

Fig. 6b: Agenda of the collaboration Workshop ***Open Innovation Facilitation in Horizon Europe***

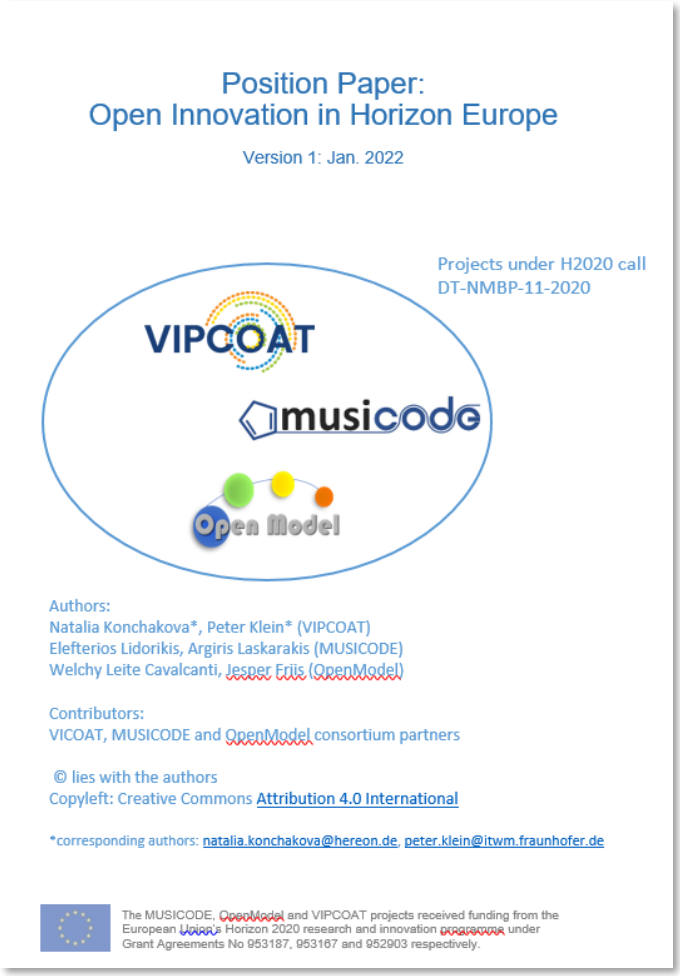
*Fig. 6c. Pictures of the knowledge-café discussions in the first day of the "**Open Innovation Facilitation**" workshop in Brussels. In the top image is Jesper Friis of OpenModel and in the bottom image is Natalia Konckakova of VIPCOAT, each chairing one of the 4 round tables.*

3.3 OIP cluster outputs

1st Position paper regarding OIP Workshop 1-3 September 2021 in Brussels

As an output to the OIP workshop in Brussels, on 1-3 September 2021, a position paper was drafted and published, in which, the **ideas of the three Horizon 2020 projects VIPCOAT, MUSICODE and OpenModel, running under call DT-NMBP-11-2020** were summarized. The aim of this position paper was to **extend the concept of Open Innovation under the Horizon Europe framework program into Open Innovation Frameworks**, compliant with the European Open Science Cloud initiatives and the European headline ambitions published by the European Commission.

The authors of the position paper are Natalia Konchakova, Peter Klein, Elefterios Lidorikis, Argiris Laskarakis, Welchy Leite Cavalcanti, Jesper Friis, and can be found at the open access repository Zenodo at the following link: https://zenodo.org/record/5848552. Fig. 7 shows different aspects and view statistics of the position paper.



Position Paper:
Open Innovation in Horizon Europe

Version 1: Jan. 2022

Projects under H2020 call
DT-NMBP-11-2020

VIPCOAT
musicode
Open Model

Authors:
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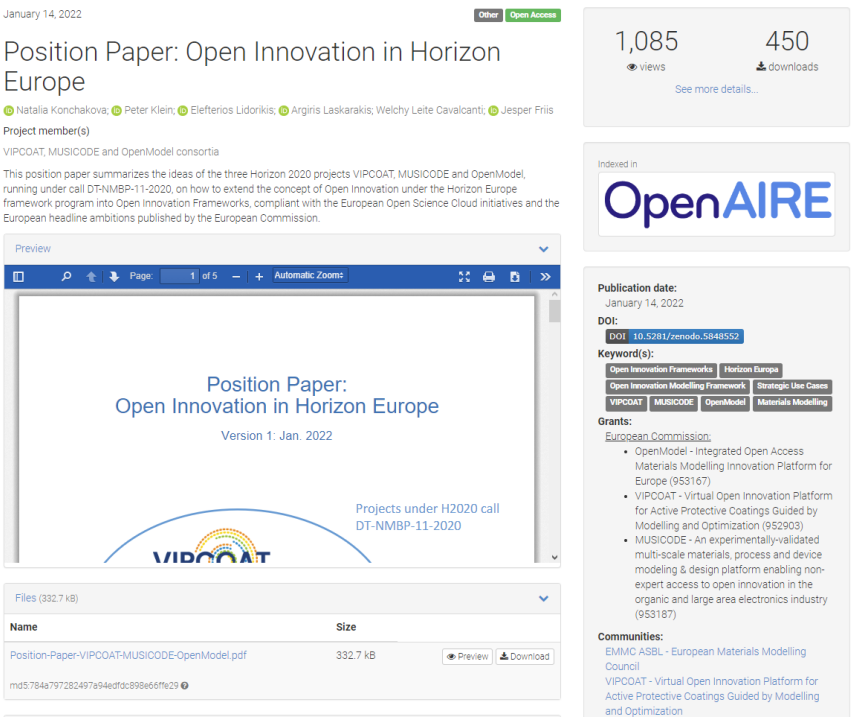
The MUSICODE, OpenModel and VIPCOAT projects received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreements No 953187, 953167 and 952903 respectively.

Fig. 7a: OIP Workshop's position paper 1st page



January 14, 2022 Other Open Access

Position Paper: Open Innovation in Horizon Europe

Natalia Konchakova; Peter Klein; Elefterios Lidorikis; Argiris Laskarakis; Welchy Leite Cavalcanti; Jesper Friis

Project member(s)

VIPCOAT, MUSICODE and OpenModel consortia

This position paper summarizes the ideas of the three Horizon 2020 projects VIPCOAT, MUSICODE and OpenModel, running under call DT-NMBP-11-2020, on how to extend the concept of Open Innovation under the Horizon Europe framework program into Open Innovation Frameworks, compliant with the European Open Science Cloud initiatives and the European headline ambitions published by the European Commission.

Preview

Page: 1 of 5 Automatic Zoom

Position Paper:
Open Innovation in Horizon Europe

Version 1: Jan. 2022

Projects under H2020 call
DT-NMBP-11-2020

Files (332.7 kB)

Name	Size	
Position-Paper-VIPCOAT-MUSICODE-OpenModel.pdf	332.7 kB	Preview Download

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1,085 views 450 downloads

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Publication date:
January 14, 2022

DOI:
DOI 10.5281/zenodo.5848552

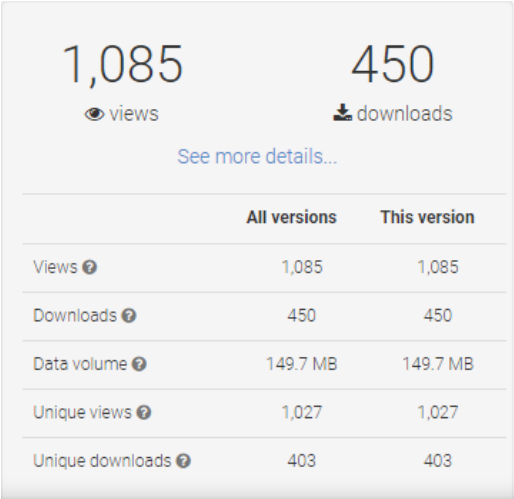
Keyword(s):
Open Innovation Frameworks, Horizon Europa, Open Innovation Modelling Framework, Strategic Use Cases, VIPCOAT, MUSICODE, OpenModel, Materials Modelling

Grants:
European Commission:
- OpenModel - Integrated Open Access Materials Modelling Innovation Platform for Europe (953167)
- VIPCOAT - Virtual Open Innovation Platform for Active Protective Coatings Guided by Modelling and Optimization (952903)
- MUSICODE - An experimentally-validated multi-scale materials, process and device modeling & design platform enabling non-expert access to open innovation in the organic and large area electronics industry (953187)

Communities:
EMMC ASBL - European Materials Modelling Council
VIPCOAT - Virtual Open Innovation Platform for Active Protective Coatings Guided by Modelling and Optimization

Fig. 1b: OIP Workshop's position paper at open access open repository Zenodo site

In Fig. 7c, the numbers of views and downloads of the position paper: Open Innovation in Horizon Europe are depicted, as well as the Data volume of the position paper. As it can be seen at the figure, the position paper has reached 1085 views and 450 downloads.



	All versions	This version
Views	1,085	1,085
Downloads	450	450
Data volume	149.7 MB	149.7 MB
Unique views	1,027	1,027
Unique downloads	403	403

Fig. 7c: Details regarding the views and downloads of the Position Paper: Open Innovation in Horizon Europe

2nd Position paper regarding OIP Workshop 5-6 October 2022 in Brussels

A second position paper is now being drafted to summarize the views and conclusions coming out from the Open Innovation Facilitation in Horizon Europe workshop that took place in Brussels, 5-6 October 2022.

EMMO Task Group on "Workflow Ontologies"

In the discussions between the three projects of the OIP cluster at the different collaboration workshops, the need of common work on defining "workflow ontologies" emerged. Different ontologies in different application domains exist, but there is still a gap in workflow ontologies. As a result, it was decided to formally formulate a new EMMO Task Group. OpenModel took the lead in arranging this.

The first meeting was held on Tuesday, 22 November 2022 12:00 – 13:00 CET, being a starting point to set the objectives of the Task Group.

3. Clustering with other Projects

1st Virtual Open Workshop Innovation 5.0: Open Translation Environment for materials and manufacturing value chains**.**

On 01-02-2022 a meeting between MUSICODE and OntoTrans projects took place. Discussions during the meeting included the introduction of the related projects, and preparations of the presentations for the corresponding Workshop (1st Virtual Open Workshop of the HORIZON 2020). It was decided that presentations should be focused on common interests, such as connectors, interfaces, ontologies, etc. Also discussed on how to connect to Marketplace, which is still not clear but there is a clear interest from both sides to collaborate on this. MUSICODE presented specifics of its platform being developed (editor, DMS, connections, data, ontologies, etc), with the BPMN editor receiving great interest.

Moreover, MUSICODE Project participated at the 1st Virtual Open Workshop of the HORIZON 2020 titled "**Innovation 5.0: Open Translation Environment for materials and manufacturing value chains**" which took place on March 15-16 2022, where the project was represented by Professor E. Lidorikis. During the workshop, the concept of OntoTrans was introduced, an ontology-based Open Translation Environment and how this can enable representation of manufacturing process challenges in a standard ontological form. This allows the connection of challenges with relevant information sources and materials modelling solutions and gives access to a holistic approach to support optimal materials and process design.

Fig. 8: OntoTrans 1st Virtual Open Workshop

Finally, MUSICODE also participated in the **OntoCommons - Global Workshop: Ontology Commons addressing challenges of the Industry 5.0 transition**, NOV 2-5, 2021.

4. Clustering Activities with EU Clusters, Councils & Networks

In the MUSICODE's framework, partners are broadening the already existing connections with specific European Networks and Clusters. These involve EMCC (European Materials Characterization Council) and EMMC (European Materials Modelling Council) to deliver information about the projects' objectives and communicate on the results, impacts and the progress of the project, but also to participate in activities that EMCC, EMMC and EPPN organize to interact with associated entities. AUTh is a member of EMCC industrial team with the mission of pushing, promoting, and introducing the industrial needs and targets within the association. Another objective is the definition of new emerging standards for surfaces and materials assessment. UoI and ANSYS are members of the EMMC, contributing to modelling and ontology.

From the modelling side, MUSICODE participated in several workshops:

- "EMMC Roadmap - Presentation of the updated version of the EMMC Roadmap for Materials Modelling and Digitalisation of the Materials Sciences" on Wednesday, September 16, 2020 / 10:00 CEST
- 3rd EMMC International Workshop 2021 taking place online from 2nd to 4th March 2021.
- EMMC Focus Area "Impact in Industry" update meeting, Wednesday, 18 May 2022 16:00 – 17:00 CET
- EMMC Online Workshop "Demonstrating the Value of Materials Modelling", on June 22, 2022 / 10:00-12:00 CEST, organized by Anne de Baas (AnnedeBaasMaterialsResearch, BE), Erich Wimmer (MaterialsDesign, FR), Ilian Todorov (STFC, UK), Kersti Hermansson (UU, SE)

MUSICODE also provided feedback to the Materials 2030 Roadmap by completing a questionnaire with discussion notes, within the frame of the EMMC International Workshop 2021. The EMMC Roadmap is based on input from all stakeholders, including industry end users and materials modelling communities identifying gaps and actions to support the increased utilization of materials modelling in industry.

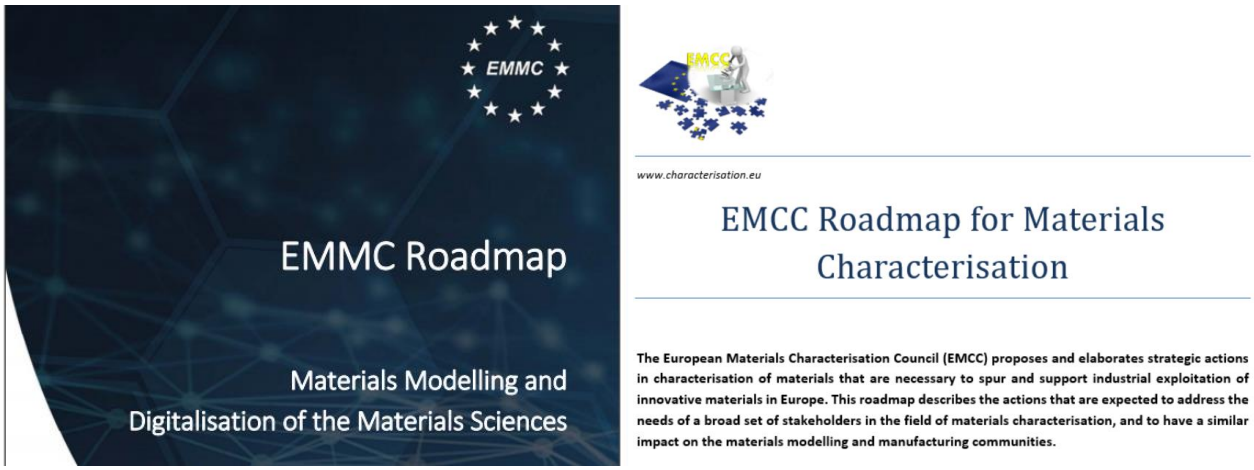


Figure 9. MUSICODE contributed to definitions in the EMMC and EMCC roadmaps

From the characterization side, MUSICODE participated in the meeting "European Materials Characterization Council and new characterization projects" organized by the EMCC Operational Management Board and the European Commission. This offered the opportunity to MUSICODE partners to get informed about common objectives and activities regarding other EU H2020 projects that will develop characterization methodologies during their implementation, to discuss about common matters and ideas, leading the way for new collaborations.

Collaboration with EMMO

MUSICODE collaborated with EMMO on the **evaluation of the MUSICODE ontology**. An online meeting was held on 23-11-2022, where Hafiz Norman (KIT) presented the MUSICODE ontology (simulation, characterization, and processing relating to the OLAE application domain) and the EMMO tools used to build it, to EMMO expert Dr. Jesper Friis (Sintef). A fruitful discussion follows with comments and recommendations so that the MUSICODE ontology is inline with the basic rules of EMMO.

Very positive remarks were received from the reviewer J. Friis. The MUSICODE ontology is very interesting and well aligned to the basic EMMO rules. Some remarks/suggestions to further improve alignment to EMMO:

- Make sure that all restrictions added to a class are valid for all individuals in this class. Try not to put so many restrictions on the parent class.
- In the measurement class, instead of “unknown” for the quantity under measurement, use “raw measurement result”
- After importing and referencing to an EMMO axiom through IRI, delete the extra relations which are not used in the target (MUSICODE) ontology
- Add “elucidation” to the classes
- Look for semantically equal object and data properties from EMMO ontology that can be used in MUSICODE.
- Follow-up in a couple of months. Also, we could briefly present our ontology in an EMMO “Workflow ontology” task group meeting.

The next meeting will be scheduled within 2023.

5. Summary

This deliverable outlined the **Clustering Activities** of MUSICODE during the realization of the project until M24 (January 2021 - December 2022). The deliverable presents an extensive description of the activities initiated both internally and externally, to broaden the project's visibility and attract relevant stakeholders, informing them about **MUSICODE's** innovations as well as to develop further collaborations for future activities in the field of Organic Electronics. Partners were quite busy in the clustering activities by organizing and taking part in international events, the connection with other **H2020 projects**, **EU Clusters** and **Councils**, as well as **EU Networks** and **Associations**.

Most notably, a close and fruitful collaboration has been established by the 3 OIP projects, with a series of common activities and workshops organized. This collaboration will have a strong impact on the scientific/technological side (ontologies, integration, interoperability), on the industrial uptake and EU policies on modelling (visibility, workshops, roadmaps), as well as on our future business plans and sustainability (common approaches and harmonized marketplace integration). These discussions and activities are only expected to increase and intensify as the OIP projects enter their second half.