

Deliverable Report

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Report on the interaction with other EU projects and EC events

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Authors	Francesca Cavezza (EAA) & Chiara Deffendi (EAA), Laura Durnford (ESC)
Contributors	Manel da Silva (EUT) Hannah Arpke (EUT)
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Summary

This report shows the efforts that SALEMA took to establish and deepen connections with other EU-funded projects that share a focus on electric vehicles (EVs), recycling, and/or the substitution of critical raw materials (CRMs) in aluminium alloys.

Through a strategic mapping of related projects, the initiative identified potential synergies and opportunities for knowledge exchange, particularly emphasising recycling processes and application in EVs. A series of workshops and events served as platforms for mutual presentations, sharing of technological, financial, social and policy expertise among stakeholders from various sectors including industry, academia, policymaking and the general public. These interactions were aimed at enhancing the visibility of collaborative efforts, raising awareness about CRMs and establishing connections with pertinent European networks.

Furthermore, the report documents participation in external events organised by other projects, demonstrating an active role in the EU's broader research ecosystem and a commitment to disseminating findings and fostering collaboration.

Disclaimer

This publication reflects only the authors' view. The Agency and the European Commission are not responsible for any use that may be made of the information it contains.

Abbreviations

Abbreviation / Acronyms	Description
CRM	Critical Raw Material
EV	Electric Vehicle
IPCEI	Important Project of Common European Interest
LIBS	Laser-Induced Breakdown Spectroscopy



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1. Introduction and Background

The SALEMA project stands at the forefront of addressing critical challenges in the automotive sector, particularly focusing on the substitution of critical raw materials (CRMs) in aluminium alloys for electric vehicles (EVs). This initiative, underpinned by the European Union's Horizon 2020 research and innovation programme, aims to foster a more sustainable and resource-efficient future for automotive manufacturing. Through its engagement with various EU-funded projects and events, SALEMA sought to enhance cross-fertilisation of ideas, share best practices, and collaborate on innovative solutions that promote the use of lightweight and sustainable materials.

Objectives of this deliverable include highlighting related projects within the EU framework that align with SALEMA's goals, detailing the consortium's efforts to promote synergy and knowledge exchange amongst these initiatives, and outlining the impact of such collaborations on the broader objectives of resource efficiency and sustainability in the automotive industry.

1.1. Objectives of task and deliverable

- *Create synergies with existing European and national initiatives as mandated by the Grant Agreement.*
- *Foster cross-fertilization with other EU projects*
- *Seek cooperation with relevant stakeholders, including automotive associations and research organizations, to promote SALEMA objectives and facilitate concrete collaboration.*

2. Mapping of related EU activities

Mapping of EU-funded projects with similar focus areas to SALEMA's was conducted, particularly in the first half of the project as this then allowed time to benefit most from these synergies. The aim of this mapping was to pinpoint pertinent projects and explore potential synergies and knowledge exchange among them.

Emphasis was placed on projects centred around EVs, with a particular focus on recycling. Some projects related to CRMs were also considered. However, given the extensive range of materials classified as CRMs and the variances in their extraction and recycling processes, it was decided to prioritise projects focusing on recycling.

Among these projects, those highlighted in a different colour in Table 1 below indicate instances where some form of contact and collaboration took place. The nature of these collaborations is further elaborated in the next chapter.

Table 1 Comprehensive overview of EU initiatives for synergistic collaborations: highlighted rows indicate active interactions between SALEMA and the projects

Acronym	Project objective	Duration	Funding Scheme
LEVIS	Focuses on examining multi-material structural components utilising thermoplastic-based carbon fibre-reinforced plastics. Integrates them with a structural health monitoring system. Primary goal: achieve substantial weight	2021-2024	H2020-LC-GV-2020



	reduction while maintaining mechanical performance of targeted parts.		
SCREEN 2	Supports the Commission in policymaking related to CRMs. Develops a network and publishes sector-oriented outlook reports analysing future supply and demand of CRMs.	2020-2023	H2020 3.5.3
TREASURE	Assesses positive and negative implications of circular economy practices in car manufacturing. Focuses on facilitating adoption of CRM recovery and circular economy principles, with strong emphasis on electronics.	2021-2024	H2020-3.5.4
Fatigue4light	Developing new tests and computer simulation methods to accurately estimate fatigue life of vehicle chassis components. Aims to select optimal materials for lighter vehicle chassis, incorporating eco-design and circular economy aspects.	2021-2024	H2020-EU.3.4.
Alufoam	Developed a pioneering recycling technology to transform non-recyclable aluminium waste into reusable material. Produces aluminium foam panels with exceptional energy and noise absorption capabilities, catering to needs of vehicle parts manufacturers, designers and architects.	Jan to June 2019	H2020-EU.3.
Multi-moby	Designing a fleet of multi-passenger and multi-purpose commercial vans with enhanced safety features and autonomous capabilities. Focuses on advancing technology for safe and affordable EVs.	2020-2023	H2020-EU 3.4
FLAMINGo	Aims to produce high-performance lightweight aluminium nano-composite materials for automotive parts, employing innovative metallurgical and forming approaches.	2021-2025	H2020-LC-GV-2020
Alliance	Aims to develop novel advanced materials and production technologies for vehicles, targeting a significant weight reduction and cost efficiency. Includes development of software tools and methodologies for accelerated technology assessment.	2016-2019	H2020-EU.2.1.3
ASTRABAT	Developing optimal Lithium-ion battery solutions for EVs, utilising hybrid electrolytes and advanced materials to enhance performance and safety.	2020-2023	H2020-EU2.1.3



Flexcrash	Developing a flexible, hybrid manufacturing technology to enhance weight reduction and crash resistance by locally reinforcing areas critical for a crash event, creating safer, lighter structures compared to current solutions.	2022-2026	Horizon- CL5-2021-D6-01-10
Marbel	Aims to accelerate mass market adoption of ultra-high-performance batteries for EVs by designing and demonstrating next-generation battery packs with improved energy density and shorter recharging times. The design of the battery box used in Marbel was used in SALEMA.	2021-2024	H2020-EU.3.4.
AUSOM	Aims to bring to market a robust cost-effective technique based on laser induced breakdown spectroscopy (LIBS) for sorting shredded scrap metal.	2020-2022	EIT Raw Materials
IPCEI Batteries	Brings together key European players at various levels of the battery value chain, from mining to repurposing, recycling and refining, through the development of advanced materials and manufacturing of cells, modules and systems, as well as dedicated software and testing systems and solutions.	/	IPCEI
PASSENGER	It aims to develop innovative solutions to reduce EU dependency on rare-earth raw materials for permanent magnets, utilizing sustainable substitution models and innovative technologies.	2021-2025	H2020-SC5

Cross-fertilisation activities within SALEMA project

This section outlines the strategies used to promote knowledge sharing among various EU projects. A primary method of interaction was for each project to present the work of another project at their own organized public events, mainly in the form of workshops.

These workshops were meticulously crafted to achieve several objectives:

- Facilitate extensive sharing of technological, financial, social and policy expertise and knowledge among stakeholders, including key industrial players, associations, academia, policymakers and the general public.
- Enhance the visibility of SALEMA within relevant circles.
- Raise awareness regarding the significance of CRMs and recycling within the automotive industry.
- Establish connections between SALEMA and pertinent European networks.

These collaborative exchanges with other EU projects were instrumental in enriching the knowledge base and fostering synergies within the industry and other relevant stakeholders. Through bilateral exchanges as well, SALEMA engaged with other projects to exchange insights, methodologies and best



practices, thereby amplifying the impact and reach of collective efforts towards sustainable automotive solutions.

This deliverable solely concentrates on the actions undertaken to foster synergies among various EU-funded projects, while deliverable report D9.4 comprehensively addresses the workshops and events conducted under SALEMA on a broader scale, including data such as the number of registered people.

2.1. First workshop

The first workshop took place on two mornings on 8–9 November 2022, with the title *‘Driving sustainable aluminium: recycling and critical raw materials for aluminium alloys in e-mobility’*.

Within this workshop, which is described in more detail in D9.4, three different projects were presented on November 9:

- AUSOM, presented by Dillam Diaz Romero from KU Leuven
- IPCEI Batteries, presented by Claudio Mus, Endurance
- Marbel, presented by Sylvia Andreas Cruz Torrez, Eurecat

A detailed agenda of the event for day 2 is presented in Annex A.

Dillam Diaz Romero presented "The AUSOM Project and Deep Learning Methods for LIBS-Based Sorting", delving into the ways in which computational systems enhance aluminium sorting. He particularly explored the application of cutting-edge deep learning strategies for material sorting using LIBS, underlining the challenges in accurately and swiftly classifying contaminated or complex materials. The presentation included the development and evaluative phases of a novel sorting system poised for commercial deployment, spotlighting the critical role of pilot-scale testing and continuous research and development endeavours. Notable accomplishments included the system's remarkable accuracy—approximately 98%—in distinguishing between various aluminium types (cast and wrought), achieved by employing Dense Convolutional Network (DenseNet) on RGB+D imagery. DenseNet represents a deep learning framework distinguished by its layer-to-layer connectivity in a forward sequence. This leap in classification precision is pivotal for improving sorting efficiency. Moreover, the project investigates techniques for concurrent mass estimation and material classification to refine the sorting system's efficacy, showing proficiency in real-time analysis of diverse metals. It also tackles potential challenges such as surface contamination and overfitting to guarantee application robustness. The participants displayed significant interest in the presentation, particularly regarding the rapid operational speed of this technology and the required cleanliness level of the scrap for effective analysis using LIBS.

In relation to the SALEMA project, both initiatives emphasise the integration of LIBS technology and Artificial Intelligence (AI) in sorting aluminium alloys. This synergy aims to elevate the efficiency of recycling processes, showing a shared commitment to advancing recycling through technological innovation.



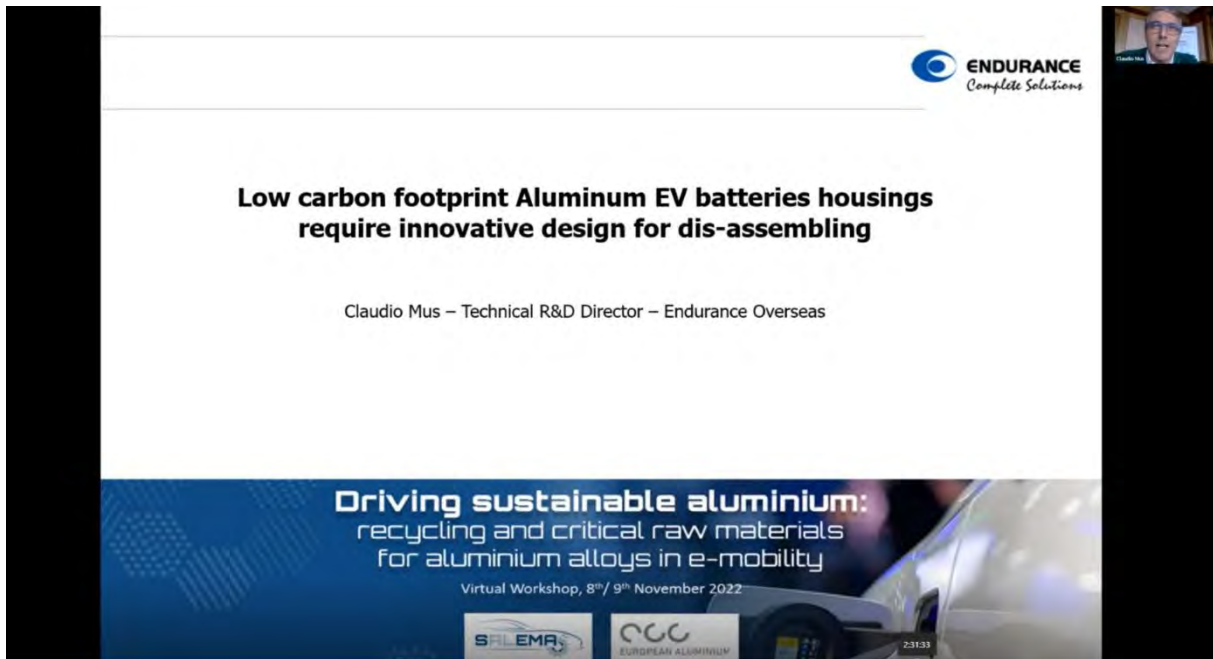


Figure 1 Claudio Mus presenting the IPCEI Batteries project during the SALEMA workshop on 9 November 2022

The **IPCEI Batteries** presentation emphasised the crucial aspects of EV battery-housing design, including the need for easy disassembly and a modular design approach to support the second life of Li-Ion batteries effectively. Claudio Mus highlighted the specific low-carbon footprint aluminium alloys that were selected for their exceptional thermal and corrosion resistance properties. These alloys play a pivotal role in meeting the stringent requirements for EV battery housings while promoting environmental sustainability. The presentation detailed the criteria for repurposing EV batteries, including guidelines for disassembly. To facilitate the recycling process, these guidelines advocate for the use of a minimal variety of materials and the application of reversible joining methods, such as screws or bolts, instead of permanent adhesives, to ensure easy separation of module elements. A notable aspect of the presentation was a focus on a modular approach to both battery and housing design. This approach allows for flexibility in the repurposing process, offering tailored solutions that can adapt to various requirements and conditions. It was concluded that fulfilling EV battery housing requirements with low-carbon-footprint foundry aluminium alloys is feasible and beneficial. Mus underscored the importance of applying specific product design criteria to ease the assembly and disassembly process, thus making Li-Ion battery repurposing viable and environmentally friendly. A modular approach to design further enhances this potential, providing flexible and sustainable solutions for the EV industry.

The participants actively engaged in discussion, particularly enquiring about the comparative advantages of aluminium versus other materials for manufacturing battery boxes, as well as the distinct roles and benefits of cast aluminium versus aluminium profiles.

Endurance Overseas, under the representation of Claudio Mus, is a participant in the SALEMA project. Given that **SALEMA** focused on exploring the application of aluminium in various EV components, such as the battery box, the IPCEI Batteries project held significant relevance for SALEMA's objectives.

The **MARBEL** project is highly interconnected with SALEMA, as the design of the battery developed in MARBEL was then used in **SALEMA**. This presentation provided a detailed overview of the



development and advantages of new partially recycled high-performance aluminium alloys for use in lightweight extruded battery packs. It set forth the MARBEL project's objectives, such as weight reduction, reduced charging times and enhanced lifecycle assessment (LCA) through modular design. Further, it elaborated on the environmental benefits of using recycled aluminium and the specific attributes of the new alloys. The significance of scrap quality and the need for stringent scrap classification to achieve these high-performance alloys were also discussed, underlining the role of aluminium in advancing automotive applications and sustainability.

The participants were especially interested in the critical factors that help in designing a battery box.

2.2. Cross-Fertilisation event

On 6 October 2023, an online cross-fertilisation event was hosted by SALEMA to enhance collaboration among diverse EU projects that are centred on automotive advancements, specifically focusing on aluminium. The webinar, titled "*Circular Metal for Future Mobility: Aluminium for Lightweight and Sustainability*", aimed to bridge the gap between projects by sharing insights and fostering innovation. The full programme is available in Annex B, while a recording and presentation of the event can be found in this SALEMA project [news article](#).

The projects featured in this event were:

- [Fatigue4Light](#), presented by Lucia Barbu, Cimne
- [FLAMINGo](#), presented by Alvise Bianchin, MBN
- [FLEXCRASH](#), presented by Sergi Parareda Oriol, Eurecat and Andoni Agirre Mentxaka, Gestamp

Lucia Barbu's presentation on **Fatigue4Light** spotlighted the pivotal role of aluminium in crafting innovative solutions for EV chassis components. The focus was on aluminium's versatility in enhancing fatigue resistance, reducing costs and improving environmental sustainability through increased scrap usage. The Fatigue4Light project, highlighted for its advancements in fatigue modelling and rapid testing methodologies, aims to significantly boost the deployment of lightweight materials in chassis parts. A key highlight was the development and testing of hybrid Al-GFRP (Aluminium-Glass-Fibre Reinforced Polymer) lower control arms, demonstrating potential weight reductions and performance improvements. Participants were particularly interested in the selection and performance of aluminium alloys used in testing, specifically enquiring about the process for choosing scrap-based aluminium alloys and any differences observed in their performance. This question highlighted a keen interest in understanding the practical aspects of materials selection and the impact of recycling on the properties of aluminium alloys used in automotive applications. The response emphasised reliance on the expertise of the Fatigue4Light aluminium supplier, ProfilGlass, which was also part of the SALEMA consortium, and the decision to focus on alloys 6082 and 6181, based on their performance, with a slight preference for 6181 for the hybrid demonstrator due to its better fatigue performance.

The presentation titled "*FLAMINGo Circularity Feasibility: Effects of Nanoparticle Inclusion in Aluminium Alloys*" discussed the **FLAMINGo** project, which explores enhancing aluminium metal matrix composites with nanoparticles. The focus is on improving the strength and lightweighting of aluminium for use in vehicle components, specifically aiming to make electrical vehicles lighter and more efficient. The presentation addressed challenges like nanoparticle dispersion, safety, affordability and recyclability in the context of existing aluminium recycling methods. This involves extensive testing, including manufacturing processes like casting and extrusion, and aims to produce components with a significant weight saving, potentially up to 30-50% for specific parts. The project



also considered the wider impact of using nanoparticles, aiming to establish guidelines for recycling and standardisation to promote the adoption of these advanced materials in the automotive industry and beyond. Participants were particularly interested in how to integrate nanoparticles in the melt, and in the improvement of mechanical properties through nanoparticles inclusion and its effect on fatigue, suggesting that the long-term durability and reliability of these materials under cyclic loading conditions should be considered.

Questions from the audience focused on the practical application of the project's findings, particularly the scalability of the proposed technologies and the transition from simulation to physical testing. There was interest in understanding the limitations of current simulation tools and how FLAMINGo might contribute to improving these tools for more accurate predictions of material behaviour and crash outcomes. Furthermore, queries about the integration of new manufacturing technologies into existing production processes indicated a keen interest in how these innovations could be applied practically within the automotive industry to enhance vehicle safety and environmental performance.



Figure 2 Sergi Parareda Oriol presenting the Flexcrash project during the SALEMA webinar on 6 October 2023.

The presentation titled "*Innovations in Automotive Safety and Sustainability: The Flexcrash Project's Pioneering Approach*", delivered by Sergi Parareda and Andoni Agirre, offered an insightful overview of the groundbreaking efforts within the **Flexcrash** project. This initiative, focused on leveraging flexible and hybrid manufacturing technologies for green aluminium, aims to forge crash-tolerant structures that significantly enhance vehicle safety and environmental performance. The presentation provided a deep dive into the collaborative efforts of ten partners across five European countries, aiming to redefine traditional automotive manufacturing processes over a four-year span, with a substantial budget backed by the European Commission.

The presentation meticulously outlined the project's aspirations to reduce vehicle weight and increase safety, aligning with the European Green Deal objectives for a sustainable automotive sector. The speakers highlighted innovative manufacturing techniques to apply surface patterns on vehicle parts, aiming to optimise crash performance and increase the circularity of automotive components.

Throughout the session, the presenters emphasised the project's dual focus on advancing passenger safety and promoting environmental sustainability through the use of green aluminium alloys. They discussed the challenges and advancements in creating new material blends and manufacturing processes that could lead to a 10-20% weight reduction in vehicle structures while maintaining, or even enhancing, their crashworthiness.

Questions from the audience reflected a keen interest in the practical application of the project's outcomes. Enquiries focused on the scalability of the proposed technologies, the transition from simulation to physical testing, and the potential integration of these new manufacturing technologies



into existing production processes. Participants expressed curiosity about the limitations of current simulation tools and the project's contribution to improving these tools for more accurate material behaviour and crash outcome predictions. Further questions delved into how the project intends to balance the innovative manufacturing processes with economic and ecological considerations, particularly in terms of integrating such technologies into the broader automotive industry to enhance vehicle safety and sustainability.

Participation of SALEMA in events organised by other projects

SALEMA was showcased across multiple European Union projects. In Table 2 below, there is a compilation of the projects where SALEMA was featured.

Table 2 SALEMA dissemination within other EU-funded projects' events

Partner disseminating	When	Host project	Event scope	Kind of event	Kind of participation	Link
European Aluminium/ESCI	06/10/2022	FLAMINGO	Organised by European Aluminium/ESCI to discuss on collaborative dissemination activities	Private Meeting	Online	link
European Aluminium	09/02/2023	FLAMINGo	Focused on LCA techniques for automotive value chain	Public event open to everyone	Online	AGENDA
Eurecat	16/03/2023	MARBEL	Focused on project progress updates, specifically developments shared among teams, such as the design of the battery box.	Private meeting	Hybrid	NA
Eurecat	11/12/2023 - 18-04/2024	PASSENGER	Organised by PASSENGER to cross-fertilise with LIFE , INSPIREE and DIGIECOQUARRY	Private meeting	Online	NA



Eurecat	04/04/2024	Flexcrash	Explored the forefront of innovation and cutting-edge methodologies, spotlighting latest breakthroughs in lightweight and sustainable materials for the automotive industry.	Public event open to everyone	Hybrid	AGENDA
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3. Conclusions and Outlook

The activities detailed in this report underscore the SALEMA project's pivotal role in spearheading collaborative efforts towards sustainable automotive manufacturing practices. The cross-fertilisation events and participation in projects hosted by other EU initiatives not only broadened the scope of knowledge exchange but also highlighted the critical importance of innovative materials and recycling techniques in the transition towards a more sustainable automotive sector.

Key findings from these interactions reveal a growing consensus on the need for a holistic approach to sustainability, encompassing the entire lifecycle of automotive components from design to end-of-life recycling. The discussions and collaborations fostered through SALEMA's engagement with other projects laid a solid foundation for future advancements in material science and manufacturing technologies.

3.1. Next steps

Not applicable as the end of the project.

Annexes

a) Annex A

Agenda of the first SALEMA workshop, day 2

'Driving sustainable aluminium: recycling and critical raw materials for aluminium alloys in e-mobility',
9 November 2022



09:00	Welcome and introduction Christian Leroy, European Aluminium
09:10	Introduction to the SALEMA project Manel Silva, Eurecat
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09:25 - 10:50	Session 3: Moving to smarter recycling of aluminium for vehicles Moderator: Philippe Meyer, Novelis and Co-chair of the Innovation Hub
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09:25	Welcome and introduction by moderator
09:30	On low CRMs alloy for foundry, extrusion and stamping Prof. Franco Bonollo, University of Padova
09:50	Aluminium recycling challenges for aluminium automotive alloys: an industrial perspective Ruggero Zambelli, Raffmetal
10:10	The Multipick technology for more circular aluminium Gregory Lewis, Comet Belgium
10:30	The AUSOM project and deep learning methods for LIBS-based sorting Dillam Diaz Romero, KU Leuven and Jonas Petersson, Swerim AB
10:50	Online networking & coffee break
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11:20 - 12:25	Session 4: Aluminium alloys and e-mobility: challenges and opportunities Moderator: Patrik Ragnarsson, European Aluminium
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11:20	Welcome and introduction by moderator
11:25	End-of-life recycled aluminium alloys for the automotive sector: challenges and opportunities Prof. Geoff Scamans, Brunel University and Innoval Technology
11:45	Low carbon footprint aluminium EV battery housings require innovative design for disassembling Claudio Mus, Endurance Overseas
12:05	New partially recycled high-performance aluminium alloys for extruded lightweight battery packs Sylvia Andreas Cruz Torrez, Eurecat
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12:25	Final remarks: Comments and wrap up by moderators
<hr/>	
12:35	Online networking & coffee break
13:15	End of the workshop

b) Annex B

Agenda of the cross-fertilisation event

Circular Metal for Future Mobility: Aluminium for Lightweight and Sustainability , 6 October 2023, Online

Time (CEST)	Session	Speaker
09:30-09:45	Introduction	Christian Leroy and Francesca Cavezza, European Aluminium
09:45 – Session 1: Setting the scene on the importance of aluminium in cars, critical raw materials and SALEMA EU project.		



Moderator: Philippe Meyer, Novelis		
09:50-10:15	Primary & secondary magnesium material flows - challenges and opportunities	Martin Tauber, International Magnesium Association
10:15-10:40	Latest insights: aluminium content in European cars	Patrik Ragnarsson, European Aluminium
10:40-11:05	SALEMA : New aluminium alloys for a circular electric mobility	Manel da Silva López, Eurecat
11:05-11:25	COFFE BREAK (stay connected)	
11:25 – Session 2: Exploring other relevant EU projects.		
Moderator: Carla Barbatti, Constellium		
11:30-11:55	Aluminium innovation for EV chassis components: hybrid solutions developed in the Fatigue4Light project	Lucia Barbu, CIMNE
11:55-12:20	FLAMINGo: circularity, feasibility and effects of nanoparticle inclusion in aluminium alloys	Alvise Bianchin, MBN
12:20-12:45	Flexcrash : new generation of crash-tolerant structures	Sergi Parareda Oriol, Eurecat Andoni Agirre Mentxaka, Gestamp
12:45-13:00	Conclusion	Christian Leroy, European Aluminium with Philippe Meyer, Novelis & Carla Barbatti, Constellium

