



NEWSLETTER °1 / November 2016

Welcome to the first newsletter from the ECO-COMPASS project!

ECO-COMPASS gathers eight European partners from six countries and eleven Chinese partners for a period of three years, until March 2019. Our fundamental goal is to develop and assess ecological improved and multifunctional composites for application in the aviation sector.

Our public newsletters will regularly keep you up-to-date on the progress made within ECO-COMPASS. What's more, you will be given a possibility to discover how the consortium partners cooperate to achieve the project objectives. You will also find out how and when we disseminate the ECO-COMPASS results. This is in case you feel like meeting with us!

Word from the Coordinators

It is with great pride and enthusiasm that we present to you the ECO-COMPASS project and its first newsletter. We believe that ECO-COMPASS will develop and assess multifunctional and ecological improved composites from bio-sourced and recycled materials for application in aircraft secondary structures and interior.

ECO-COMPASS brings together numerous partners, each one contributing with high-level experience and capacities. Our consortium represents a truly good footprint through Europe and China.

We also invite you to visit the ECO-COMPASS website (www.eco-compass.eu) which is constantly kept up-to-date. Feel free to inform us of any relevant publication, project or event which should be brought to the attention of the ECO-COMPASS community.

We are confident that the good team spirit and motivation to deliver the ECO-COMPASS targets will accompany us all along the project!

*EU Coordinator Jens Bachmann, German Aerospace Center (DLR)
Chinese Coordinator Xiaosu Yi, AVIC Beijing Institute of Aeronautical Materials*

NEWS & EVENTS

The ECO-COMPASS partners participated in the China-EU Conference on Green Aviation Research that took place on 8 November 2016 in Shanghai, China.

[>> Read more](#)

ECO-COMPASS leaflet and poster are now downloadable.

[>> Download the pdf](#)

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ECO-REINFORCEMENTS FROM BIO-BASED AND RECYCLED FIBRES

Natural fibres have been utilized by humans for a long time. Archeologists discovered flax fibres being used for clothing more than 30.000 years ago while the importance of these fibres diminished with the success of cotton. But as nowadays resources are getting scarce, the interest in renewable materials like bio-based fibres rises steadily. A multitude of bio-based fibres is available on the world market. In Europe, flax and hemp fibres are the most common bast-fibres while ramie fibres grown in China are another suitable candidate.

A drawback of natural fibre reinforced plastics (NFRP) is their lack of strength compared to glass and carbon fibre reinforced plastics (GFRP, CFRP). In theory, natural fibres can reach very high values for tensile strength, but due to imperfections and incompatibilities to certain resin systems their potential cannot be fully used in the composite. The poor interfacial bonding properties between hydrophilic natural fibres and hydrophobic polymers lead to relatively low mechanical properties of NFRP. On the other side, the low density of bio-fibres leads to good specific stiffness values comparable to GFRP with further advantages on acoustic and thermal damping due to their hollow structure.

One aim of the project ECO-COMPASS is to improve the interfacial strength and toughness of flax and ramie fibres in order to reveal their full potential in composites. Several types of modifications are under investigation, like nano-particle grafting and plasma treatment. Furthermore, a new approach to mix recycled carbon fibres with natural fibres in a hybrid reinforcement will be assessed in the project.



Figure 1 : Flax (*linum usitatissimum*) during cultivation [DLR].

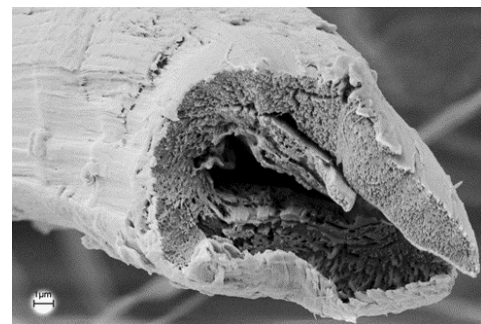


Figure 2 : SEM picture of a flax fibre [DLR]

BIO-RESINS

Bio-based resin systems, as well as their market, are plenty in expansion stage. Parallel to this fact, the ECO-COMPASS consortium is designing new strategies to introduce new renewable and reduced carbon footprint composite materials in aircraft secondary and interior structures. Specifically, in work package 3, new bio-based thermosetting epoxy resins are being selected to be applied in aeronautics.

Nowadays, several natural sources could be promising options as epoxy building blocks (figure 3). However, some of them are still in development and are not commercially available yet. It is not the case of Soybean and Linseed oils which are currently in the market as well as their epoxidized forms.

Market trends, suppliers and potential bio-based epoxy systems for aircraft applications are being studied in WP3.

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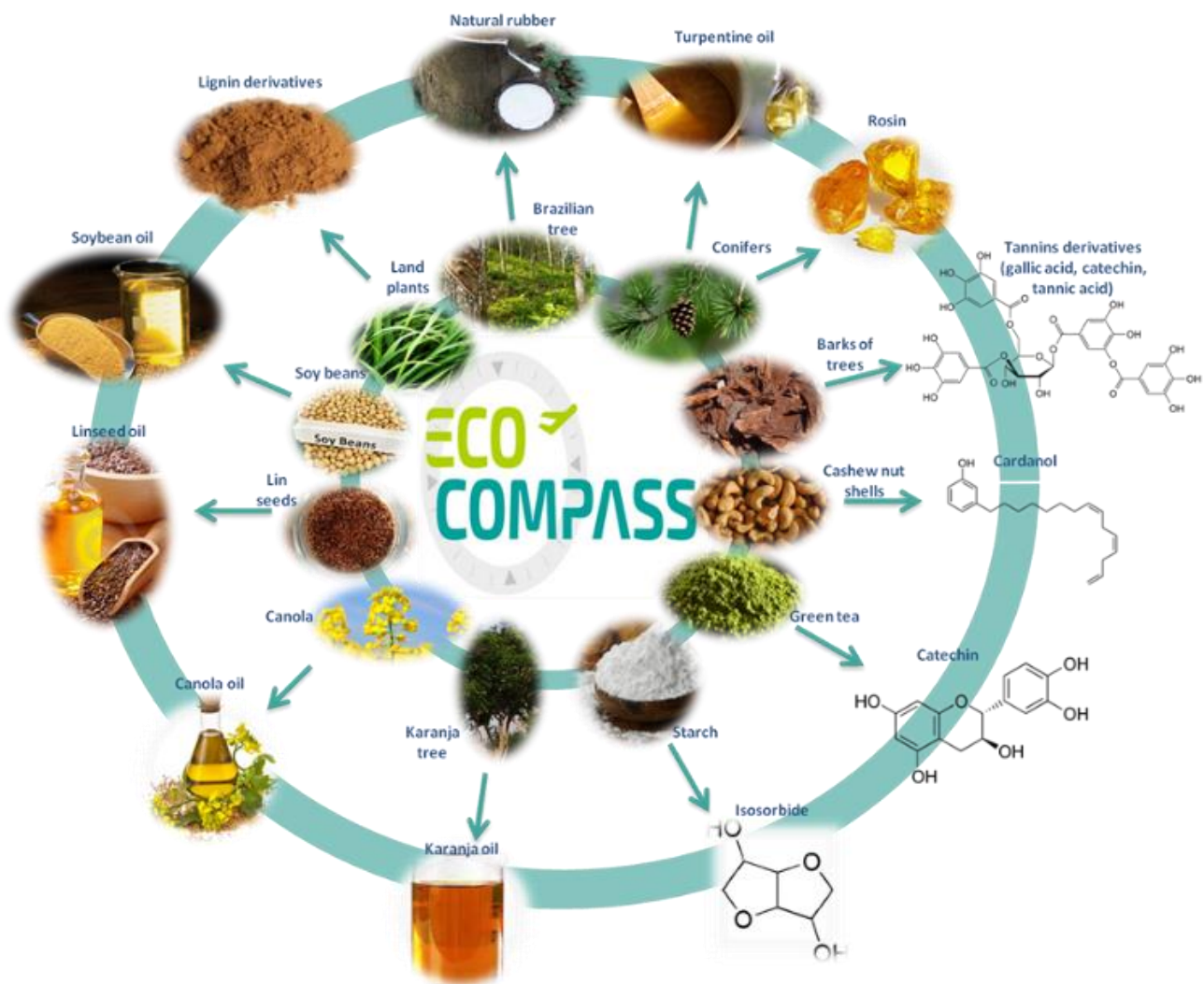


Figure 3 : Bio-sourced raw materials for epoxy building block systems.

MANUFACTURING OF MULTIFUNCTIONAL GREEN COMPOSITES AND ELECTRICAL CONDUCTIVE COMPOSITES

The activities concern the processing of characterization samples of the different materials to be evaluated within the project (green papers, honeycombs, composites materials for secondary and interior part applications

and material protection technologies). Particular attention will be paid to the control of processing parameter to guarantee final high performances of materials produced.

CHARACTERISATION

In the workpackage 5 (WP5), composite systems selected/developed during the different phases of the project will be tested and characterised. At this stage, the project members contributing in this workpackage are mainly developing the characterisation and testing programmes for the composite systems selected during the project and determining the resource available within the consortium. This work will lead to the elaboration of

the first deliverable “Characterisation and testing programme for resins and eco-composites, selected standards and testing resources across the consortium”. This will enable every project member to be aware of how the characterisation and testing programme will be performed, the test method/standard used and the resources testing available within the consortium. All the project members will have a clear view of which tests

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and which outcomes are expected within each WP and/or stage of development.

A testing matrix was created by Airbus Group Innovations highlighting the material properties and the related specifications for aerospace secondary and interior applications. Based on this testing matrix, the WP5 members provided the testing standards they are expecting to use to determine the material properties and characteristics required in their specific tasks. They also provided information about their existing testing capabilities available for the project. As expected, it was

noticed that an important testing resources exist across the consortium, which will enable a comprehensive characterisation of the eco-composite materials under consideration. An optimised work load distribution has been set to optimise the benefits of this important resource capabilities available.

Combining the information provided previously and the results of the discussions held by the partners during the meeting Shanghai in November, the characterisation and testing programme will be finalised in the coming weeks.

MODELING AND SIMULATION

The main objective of WP6 is to develop the numerical models that will facilitate the analysis of aerospace bio-composite structures. The structural elements targeted by the project are interior and secondary structures.

The numerical models that will be developed will focus on the mechanical performance and integrity of the structure, the electromagnetic compatibility and conductivity of the material and its damage resistance in case of lightning strike, the vibration and noise reduction of structure-damping composites and the design optimization of the structural elements.

Modelling techniques to be used in ECO-COMPASS project will be based on state of the art approaches such

as the numerical homogenization procedure, where the composite is characterized not with a constitutive law but instead with a finite element model (FEM) of a representative volume element (RVE) that accounts for its internal microstructure and the interaction of its components. Advanced numerical models require of material parameters to be properly calibrated. These parameters will be obtained by the ECO-COMPASS consortium. So far, the partners working in WorkPackage 6 have made a detailed description of the material parameters needed. This description will facilitate the definition of the experimental campaign required to acquire them

REQUIREMENTS, APPLICATIONS AND DEMONSTRATORS

The activities concern the definition of the material requirements for secondary structures and interior part applications as well as characterization standards. This information will be used as a reference for the activities

of the project within the different work packages. Furthermore, demonstrators will be produced regarding final applications with the developed materials and technologies.

LIFE CYCLE ASSESSMENT

The Life Cycle Assessment (LCA) is an important aspect of the project as it is a tool to evaluate the environmental impacts of the new eco-materials compared to state-of-the-art materials used in aviation today. LCA for several use-cases (interior and secondary structures) will be calculated jointly by the European and Chinese side. Not

only the carbon footprint but also other environmental impact categories like land-use and eutrophication will be assessed to find possible weak points of the novel eco-materials. A special attention will be given to the several identified modifications to improve mechanical properties of the eco-composites.

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FEEDBACK ON THE CHINA-EU CONFERENCE ON GREEN AVIATION RESEARCH

The China-EU Conference on Green Aviation Research took place on 8 November 2016 in Shanghai, China.



Figure 4 : Shanghai's Pudong skyline.

The EU ECO-COMPASS coordinator Jens Bachmann (DLR) gave a presentation entitled “Life Cycle Assessment (LCA) of ecological improved composites for aviation - A Review” co-authored with Carme Hidalgo (Leitat Technological Center) and Stéphanie Bricout (Airbus Group Innovations).



Figure 5 : Jens Bachmann (DLR).

Each participant of the Conference received a copy of the ECO-COMPASS leaflet and poster.

The Conference included 2 keynote presentations given by Dr. Laurent Bochereau (Minister Councilor, Head of Science, Technology and Environment Section, Delegation of the European Union in Beijing) and Prof. Dr. XiaSheng Sun (Chinese

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Aeronautical Establishment, CAE, China), and 13 technical presentations given by Chinese and European speakers involved in the international cooperation projects ECO-COMPASS, DRAGY, IMAGE and EMUSIC. Approximately 150 individuals attended the Conference.



Figure 6 : ECO-COMPASS consortium during the meeting in November 2016, Shanghai.

The Chinese and European ECO-COMPASS partners took the opportunity to discuss the project's activities during an internal meeting that was held from 9 to 11 November. The discussions addressed the current status of the project and the actions to take in the upcoming months.

GET TOGETHER

The [list](#) of scientific and technological events related to the ECO-COMPASS research fields can be found on our website. The file is regularly updated. Don't hesitate to inform us of any other event likely to interest the ECO-COMPASS community. Hereunder you will find a short selection of major events to take place in the upcoming months.

ICAS 2017 02-03 FEBRUARY 2017, MELBOURNE, AUSTRALIA

The 19th International Conference on Aeronautical Sciences provides a premier interdisciplinary platform for researchers, practitioners and educators to present and discuss the most recent innovations, trends, and concerns as well as practical challenges encountered and solutions adopted in the fields of Aeronautical Sciences. Source: <https://www.waset.org/conference/2017/02/melbourne/ICAS>

4TH INTERNATIONAL CONFERENCE ON BIOBASED MATERIALS AND COMPOSITES 29-31 MARCH 2017, NANTES, FRANCE

The goal of this conference is to foster understanding, scientific and technical progress, and recent knowledge in the field of natural polymers extraction, biopolymers, biomaterials and their blends, composites, biobased materials for energy conversion and IPNs. This conference will provide a discussion forum for the worldwide community of scientists and engineers in the field of bio-based materials and composites. Source: <https://symposium.inra.fr/icbmc2017>

ICCS20 04-07 SEPTEMBER 2017, PARIS, FRANCE

The 20th International Conference on Composite Structures will provide a forum for the presentation and discussion of the latest research and innovations in all aspects of composite structures and materials. Source: <https://events.unibo.it/iccs20>

CEAS 2017 16-20 OCTOBER 2017, BUCHAREST, ROMANIA

The Aerospace Europe CEAS 2017 Conference brings together academic, research, industry and operator representatives for a fruitful date exchange of the latest ideas and developments in European aeronautics and aerospace. Source: <http://ceas2017.org/>

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INTERVIEW

ECO-COMPASS newsletters offer you the possibility of getting to know some of the project partners a little better... Thus, the interviews section will let you discover the day-to-day life of the people involved in achieving the ECO-COMPASS goals.

In this edition of the ECO-COMPASS newsletter # 1, we propose you several tags which will lead the interview with the project coordinators:

JENS BACHMANN, GERMAN AEROSPACE CENTER (DLR) **XIAOSU YI, AVIC BEIJING INSTITUTE OF AERONAUTICAL MATERIALS**

Q1: What factors / observations are at the origin of the ECO-COMPASS project? What are the challenges for the project?

Xiaosu Yi (XY): During the GRAIN and GRAIN 2 projects, both sides identified and recognized the importance of materials for the future green aviation industry, because materials and manufacturing technologies are so critical and basic. And both China and Europe are facing the resource and environmental problem in aeronautical materials.

The major challenges of the ECO-COMPASS project remain an effective cooperation with each other as we have different backgrounds, different research cultures, we speak very different languages and implement different management and evaluation systems. The geographical separation of the project teams is also a very challenging factor.

Jens Bachmann (JB): Environmental impact of the transport sector and especially aviation is a global challenge. Therefore it is a good idea to work on materials that have the potential to decrease environmental impact on a global scale, too. Based on the identified research fields in the GRAIN project, ECO-COMPASS was set up to work on these topics in the collaboration of Europe with China.

Of course the huge distance between Europe and China is a challenge for the exchange of materials and limits also the number of face-to-face meetings with each other. Therefore the constant exchange of information by email, telephone conferences and a joined internet platform is of vital importance for the success of the project.

Q2: How did you manage to create the international collaboration and team spirit around ECO-COMPASS?

XY: There are two important aspects. The first one is to identify the strengths of each partners, particularly the interaction between the Chinese and European partners. The second one is to think about how to maximize the strengths and potentials through joint efforts. On the Chinese side, we have organized two project meetings within the first six months of the project to align and focus our efforts on the targets. In cooperation with European

partners, we use not only the standard means like email, but we also share a project-specific web-based platform for exchange information and results.

JB: A very important prerequisite for the international cooperation is to set up efficient ways of communication. With the kick-off meeting in Brussels and the recently held conference in Shanghai, we had the opportunity to discuss with all partners face-to-face. Apart from these important but rare personal meetings we encourage all partners to stay in contact by regular telephone calls and information exchange on work package level for more detailed discussions and collaboration.

Q3: What is the added value of such an international project for the aviation sector? How will the end-users benefit from the project results?

XY: A special feature of ECO-COMPASS is that the Chinese parties largely do the research and development on new materials and then provide these as trial products to the European parties for testing, modelling and manufacturing. The European parties then feedback the results to the Chinese parties for further modification. Through the interaction, it is obvious that this will enhance the technical readiness level of the materials and process technologies, and will help end-users to understand and use the green materials.

JB: The attractiveness of the collaboration lies in the opportunity to assess a wide range of materials that are under development in China and Europe to enhance their TRL level. The European partners will not only test Chinese materials but also develop own reinforcements and modifications to improve the eco-composite properties. This should enable the project to assess a broad range of materials and modification for their application in aviation and of course other transportation sectors with less demanding requirements. Finally, we expect the results of the jointly carried out Life Cycle Assessment to be helpful to identify material solutions with less environmental impact compared to synthetic materials used today. ECO-COMPASS offers also a great chance to build up new relationships between both continents for future research topics

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