PROJECT PERIODIC REPORT

Grant Agreement number: 214660

Project acronym: SustainComp

Project title: Development of sustainable composite materials

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Date of latest version of Annex I against which the assessment will be made: March 31, 2011

Periodic report: 1st ☐ 2nd ☐ 3rd X 4th ☐

Period covered: from March 1, 2011 to August 31, 2012

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3.1 Publishable summary

3.1.1 SustainComp – Development of Sustainable Composite Materials

The SustainComp project is a large-scale collaborative project within the EU 7th frame work programme. The overall aim of the project is to develop new types of sustainable composite materials for a wide range of applications, and it has the ambition to integrate today's large enterprises on the raw material and end-use sides (e.g. pulp mills and packaging manufacturers) and small and medium sized enterprises on the composite processing side (e.g. compounders and composite manufacturers). This four year project started on September 1, 2008, and has a total budget of 9.4 million Euro of which the funding from the European Commission is 6.5 million Euro.

This is the project logotype:

SustainComp

3.1.2 SustainComp objectives

The **first objective** for SustainComp is to combine ecodesign, innovative materials solutions and process developments to develop new advanced demonstrators of sustainable products within each of the following product families:

- Nano-reinforced foams – to replace styrofoams in the packaging and construction sector.
- Nanostructured composites – e.g. electrical and general household appliances, fast rotating consumer goods.
- Moulded type of composites – to establish advanced cellulose reinforced biocomposites in e.g. the transportation (vehicles) and construction sectors.
- High throughput nanostructured membranes with designed selectivity – for small scale liquid applications in the medical field to large scale municipal applications.
- Stimuli-responsive aerogels – e.g. for noise/vibration dampening.

Since the project also addresses several generic problems in the sustainable composites sector, the **second objective** is to solve some of these generic problems by which the property space of sustainable biocomposites can be significantly widened, resulting in larger potential markets for these materials.

The **third objective** is to:

- Minimize the environmental impact by the application of an ecodesign perspective for the conceived new products.
- Reach markets not directly targeted by the project, since it is expected that a successful, cost-effective manufacture of microfibrillated cellulose will be useful in other sectors such as the food sector (rheology modifiers) and the paper/board and coating sectors.

3.1.3 SustainComp consortium

The SustainComp project is executed by a consortium composed of 17 organisations from eight European countries. The involved organisations are listed below:

Industrial partners

3A Composites, Switzerland
Borregaard, Norway
Elastopoli, Finland
K-Tron, Switzerland
Novamont, Italy
Polykemi, Sweden
SCA, Sweden
BASF, Germany

Research institutes

Innventia, Sweden
CNRS (Centre National de la Recherche Scientifique), France
EMPA (Eidgenössische Materialprüfungs- und Forschungsanstalt), Switzerland
ITENE (Instituto Tecnologico del Embalaje, Transporte Y Logistica), Spain
PFI (Papir- og fiberinstituttet), Norway
Stiftelsen SINTEF, Norway

Universities

EPFL (Ecole Polytechnique Fédérale de Lausanne), Switzerland
Aalto University, Finland
KTH (Royal Institute of Technology), Sweden

The coordinating organisation is Innventia, and the coordinator is Mikael Ankerfors (mikael.ankerfors@innventia.com)

3.1.4 SustainComp website

The SustainComp project has an open website available on www.sustaincomp.eu and www.sustaincomp.com. On the website, information about the project vision, goals, consortium and events are published. Also, open results are available for download.

3.1.5 SustainComp overall structure

The SustainComp project is structured in five tightly connected technical work packages (WPs) covering the different parts of the project (see Figure 1) and one coordinating work package.

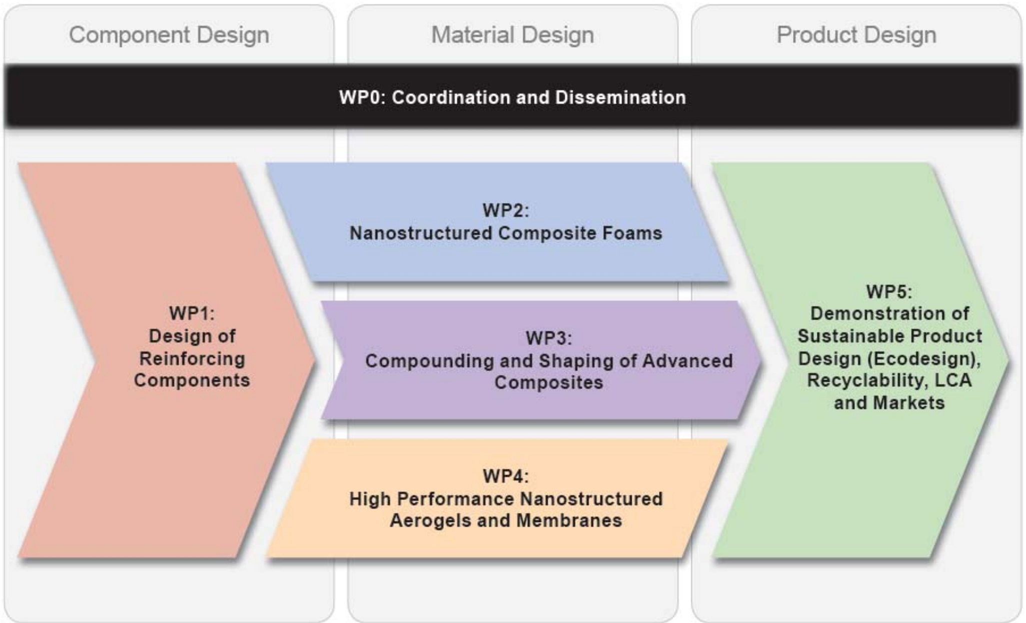

Figure 1: Work package structure of SustainComp

3.1.6 SustainComp achievements in the first two project phases

The work in SustainComp is carried out in three project phases as illustrated below (Figure 2).

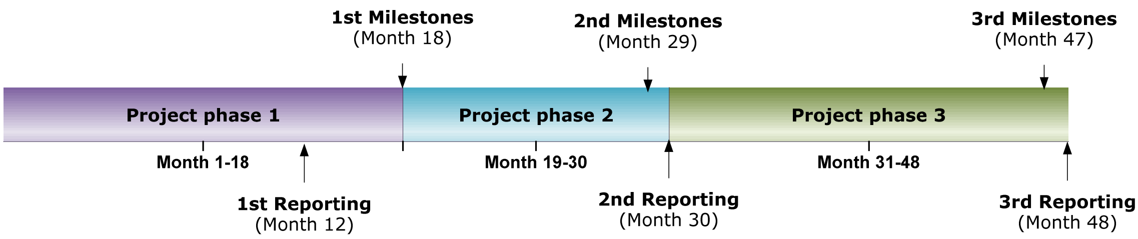

Figure 2: The timing of the different project phases, milestones and reporting in SustainComp

The project is now at the end of period 3, focusing on the demonstration. A short summary of the key achievements during the period in the different work packages is given here.

Work package 0

- General assembly and Executive Board meetings have been arranged.
- The external website has been updated regularly (www.sustaincomp.eu)
- The final open conference was arranged in Stockholm June 14-15, 2012.

Work package 1

- At least two chemicals have been identified that possibly could alleviate hornification of microfibrillated cellulose (MFC).

Work package 2

- Different compounding strategies for producing composites have been investigated with always the objective to obtain optimum preforms for the foaming processes.
- Optimized wet mixing methods were used for producing sheet preforms to be foamed directly or to be pelletized and extruded for further foaming.
- Processing windows (viscosity, foaming temperatures, depressurization rates, etc.) were established for different grades of neat polylactide (PLA), wood-fibres (WF) and MFC composite foams. Variations of these parameters can counterbalance some of the degradation inherent to preform processing or can improve the foam ability and foam quality when adding more cellulose fibres for example.
- The role of fibres on the diffusion of CO_2 was identified (diffusion channels, gas content, etc.) as one of the key parameters to control and tailor the foam expansion, morphology and density.
- The relationships between foam density, WF or MFC content, cells structure... on the composite foams stiffness and strength were established for the studied materials.
- It has been shown by comparing numerous foams that have been produced that a wide range of density and mechanical properties can be obtained. Most of the foams produced so far meet at least the requirements of one of the demonstrators in terms of density and mechanical properties.
- New neat and biocomposite PLA foams for expanded polystyrene (EPS) replacement were successfully prepared from pre-expanded beads using a lab scale process and show promising performance for use in cushioning applications.
- Foam sheets made from neat and biocomposite PLA foams were produced in large scale.
- Foams produced for the demonstrators passed the disintegration and biodegradability tests according to standards.

Work package 3

- Four different demonstrators have been developed;
  - A sustainable compression moulded composite to be used as bus seat body work for Volvo Carrus city bus, with small modifications adjustable for other buses and trams.
  - Injection moulded biodegradable and compostable cutlery (forks and knifes) obtained from a new polymer material (in pellets form) reinforced with wood fibres.
  - Biocomposite compound in pellets form to be used further in injection moulding of plastic parts (e.g. for Lego toy building blocks).

- Biocomposite granulates to replace endangered tone woods (ebony, rosewood) having excellent sustainability and competitive cost structure for violin fingerboard.

- Fibres and plastics can successfully be mixed in sheet form and then fed into a compounding extruder to get a homogenous material.
- Proper and stable feeding of various grades of biocomposite material could be realized, upon correct configuration of feeders.
- Significant improvements in tensile properties are obtained with wood fibres
- Improved understanding of the relations between processing and effects on properties, effect of repeated extrusion etc.

Work package 4

- Of the many chemical modifications of fibrils carried out during the project, the one leading to the preparation of bioinspired wet adhesion promoting MFCs was selected as the most promising for applications.
- Highly porous wet-stable MFC-based aerogels can be prepared
- MFC based aerogels with high specific surface areas have been successfully prepared by using the new procedures for drying.
- Modified separation membranes with gradient porosity for increasing flux were used to separate model analytes.

Work package 5

- A key result of WP5 is the application of the ecodesign methodology to support the R&D activities performed by the other WPs.
- The sustainability assessments evaluated the ecodesign development path of demonstrators.
- The assessment kept track of changes and supported the industrial partners by providing suggestions to increase the overall demonstrators' sustainability
- The final prototypes have been defined and the collection process from the partners is under way.
- The final sustainability assessment retraces the developments of the demonstrators throughout the project and provides a picture of the final achievements from an environmental, economic and social point of view.