

FINAL ACTIVITY REPORT

Period: 1st April 2004 – 31st March 2006

Contract number: COOP-CT-2003-508157

Project duration: from 1st April 2004 to 31st March 2006

PROJECT CO-ORDINATOR: (1) INESCOP

PARTNERS:

- (2) GALLARDO(ES)
- (3) ANALCO (ES)
- (4) ALEJOS (ES)
- (5) ENECOL (ES)
- (6) FORMA (GR)
- (7) TIGAS (GR)
- (8) CF (IT)
- (9) DIAP (IT)
- (1) INESCOP (ES)
- (10) UPV (ES)
- (11) ELKEDE (GR)
- (12) UNIPG (IT)

REVISION [1]

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1. Project objectives and major achievements during the reporting period.

1.1. Overview of general objectives.

The **main objective** of the project is the development of new rubber compounds for outsoles and specific adhesives with properties similar to those of the conventional materials currently used. This will be done in order to **avoid the surface preparation of soling materials prior to bonding**, or at least to reduce it as much as possible, thus simplifying the overall bonding process. This means the study of modifications to be done on elastomeric materials and adhesives in order to pre-activate their reactive sites allowing bonding, and obtaining good adhesion parameters, in accordance with European standards (CEN TC309 and CEN TC193), and without these modifications affecting the final physical and mechanical properties of the soles.

The individual industrial objectives and/or targets that can be reached through the development of this project are:

- Simplified use of rubber in the footwear industry, avoiding surface treatments.
- Cost reduction in shoe factories through the elimination of one production step (ranging between 10 and 80%, depending on the avoided surface treatment).
- Elimination of hazardous chemicals from shoe factories, improving work safety conditions.
- Increase of the added value of rubber (30-40%), improving its compatibility with adhesives.
- Increase of the added value of adhesives (30-40%), improving its compatibility with rubber compounds.
- Decrease of the social costs in the companies due to the reduction of insurance costs, owing to the disappearance of the risks inherent in the storage and use of solvents and hazardous chemicals.

The measurable objectives by the end of the project are:

- Establishing a correlation between rubber compounds physical-chemical properties and adhesion properties (Milestone 1).
- Eliminating or reducing at maximum the surface treatment in rubber bonding (the elimination of at least one step of the bonding process) (Milestone 2).
- Development of modified rubber compounds/adhesives with improved adhesion behaviour (a minimum of 3) (Milestone 3).

1.2. Objectives, work performed, contractors involved and achievements.

The main objectives for two reported periods were:

- *Benchmarking* with bonding systems used by leading footwear manufacturers worldwide. According to this information, the rubbers most frequently used in the footwear industry as soling materials (vulcanised and thermoplastic rubbers), and the most common adhesives, mainly polyurethane and polychloroprene adhesives, and their standard formulations were selected.
- Modification of rubber compounds and corresponding adhesives selected in WP1 to improve adhesion properties and to provide “intelligent-multifunctional materials” with optimised properties for bonding footwear materials under acceptable process conditions.
- New materials should have properties similar to those currently used in the footwear industry.
- Selection of intelligent-multifunctional rubber compound/adhesive systems for industrial validation by SME partners in the project. At least one rubber compound/adhesive system per country and different polymeric nature.
- Industrial validation of the new materials developed in WP2 from the point of view of the adaptation of new materials to SMEs mixing processes.
- To prove that the innovative assembly process (intelligent rubber compounds and adhesives) is practical for use in footwear factories and to demonstrate that the footwear produced meets the required standards.
- Diffusion of the intelligent materials to companies of footwear sector.
- Industrial exploitation assessment.

The work performed during the two periods covered by this report has been the following:

- **WP 1.** State-of-the-art and technical limitations
- **WP 2.** Development of intelligent-multifunctional materials (rubbers and adhesives) in order to be bonded without or with the minimum surface treatment.
- **WP 3.** Industrial validation of intelligent-multifunctional materials.
- **WP 4.** Dissemination and exploitation of results. Commercial promotion.
- **WP 5.** Project Management.

Workpackage 1 has been managed by **INESCOP**, which provided some specifications for soling materials and adhesives for footwear. **Rubber compounds companies** (GALLARDO, ANALCO, ALEJOS, FORMA, DIAP) carried out the delivery of a wide range of commercial rubber compounds used as soling materials (NR, SBR, BR, EPDM, PP, among others), **adhesive companies** (ENECOL and TIGAS) and a **footwear manufacturer** (ROMAGNOLI) supplied commercial adhesives used in the footwear industry, such as polyurethane and polychloroprene adhesives. **RTD performers** (INESCOP, UPV, ELKEDE, UNIPG) of each country gathered the commercial materials supplied by SMEs and they carried out their characterisation in order to obtain a correlation between rubber properties and adhesion properties.

In this work-package, the RTD partners have worked in a **COMPLEMENTARY** way, because each one has gathered (in Task 1.1) and tested (in Task 1.2 and Task 1.3) different materials. Four kinds of materials were gathered and tested: commercial rubber compounds and adhesives supplied by the SME partners, and standard rubber compounds and adhesives manufactured by RTD centres. Working that way made possible the study of a higher number of materials, and therefore, the conclusions

obtained in this work-package will be more reliable, and will be used as a starting point to properly begin with the next work-package. Furthermore, the problem of the delivery of raw rubber compounds among the RTD partners was avoided.

At the beginning of the project, **Benchmarking** with bonding systems currently used by leading footwear manufacturers worldwide were prepared. According to this information, the rubbers most frequently used in the footwear industry as soling materials (vulcanised and thermoplastic rubbers), and the most common commercial adhesives, mainly polyurethane and polychloroprene adhesives, and their standard formulations, were selected.

As output from WP1, a report describing the state-of-the-art was delivered as **Deliverable 1**. This document included:

- Commercial and standard rubber compounds and adhesives
- Specifications for rubbers and adhesives suitable for use in footwear
- Results of characterisation of these materials
- Proposed bonding processes
- Technological limits of current bonding process

All project partners, both SMEs and RTDs centres, discussed the results obtained from WP1 in order to establish some relationships between physical-chemical properties of rubber compounds and their bondability with the adhesives most commonly used in the footwear industry, which have been delivered at **Milestone 1** (Month 9).

Finally, a selection of possible rubber compound formulations and adhesives to be modified in the Workpackage 2, was delivered at **Deliverable 2** (Month 9) and **Deliverable 3** (Month 9), respectively.

In the Work-package 2, the RTD partners have worked in a COMPLEMENTARY way, because each one has modified (in Task 2.1) and tested (in Task 2.2) different materials. The nature of rubber compounds and adhesives modified and characterized by each one of the RTD centres in the project is shown in Figure 1.

Five different kinds of rubber compounds (SBR, EPDM, SBS, NBR and TPOs compounds) have been modified by means of different routes: formulation, polymer blending, functionalisation by grafting, etc. Furthermore, three types of adhesives, polyurethane, polychloroprene and polybutadiene hot melt adhesives have also been modified by means of formulation, functionalisation or synthesis.

From working that way, it was possible to obtain a higher number of intelligent-multifunctional materials for Workpackage 3.

After that, the characterization of modified rubber compounds and adhesive formulations developed in the project was carried out. The main results from this workpackage will be reported at **Deliverable 4**. Finally, different intelligent-multifunctional rubber compounds/adhesive systems have been selected for industrial validation in WP3 and will be reported at **Deliverable 5**.

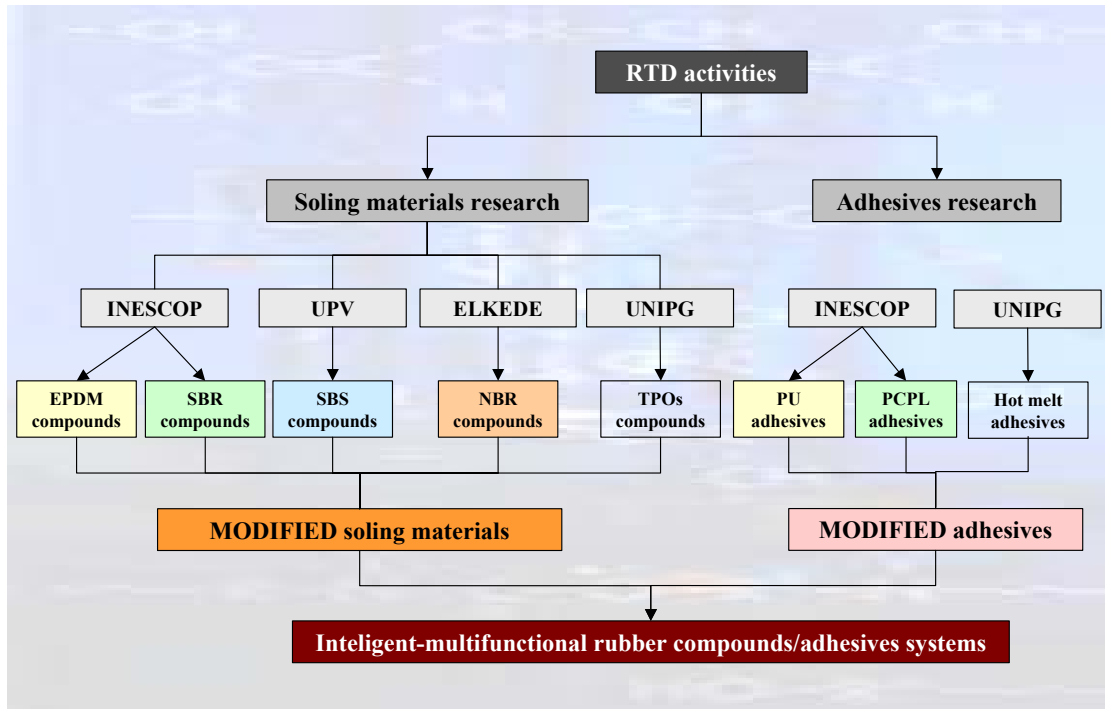


Figure 1

According to the results obtained in WP2 the **Milestone 2** of the project was successfully achieved. Output from the project's different rubber compounds/adhesive systems which comply with the footwear specifications, where the surface treatment prior to bonding is not necessary, is available. In some cases, the two steps of the surface treatment were avoided, roughened and halogenated. In other cases, only the chemical treatment (halogenation) or UV treatment were avoided because a roughened treatment is necessary in order to obtain adequate green strength.

In WP3 "*Industrial validation*", a planning of the industrial trials was designed and discussed (Figure 2). In this workpackage, the industrial viability of the new rubber compounds and adhesives developed in the previous workpackage from the point of view of the adaptation of new materials to SMEs manufacturing processes has been assessed.

In this sense, rubber compounds SMEs have prepared modified rubber compounds (SBR, SBS, EPDM, NBR and TPO) using their own mixing equipment: bamburies and mixing mills for vulcanized compounds and extrusion mills for thermoplastic compounds. After that, different models of soles have been moulded for men's and women's shoes. In the same way, adhesive SMEs have prepared modified adhesive formulations based on polyurethane, polychloroprene and polybutadiene hot melt.

Quality control on soles and prepared adhesives was carried out in order to analyze the suitability of the materials (rubber compounds and adhesives) developed according to specifications given in European footwear standards.

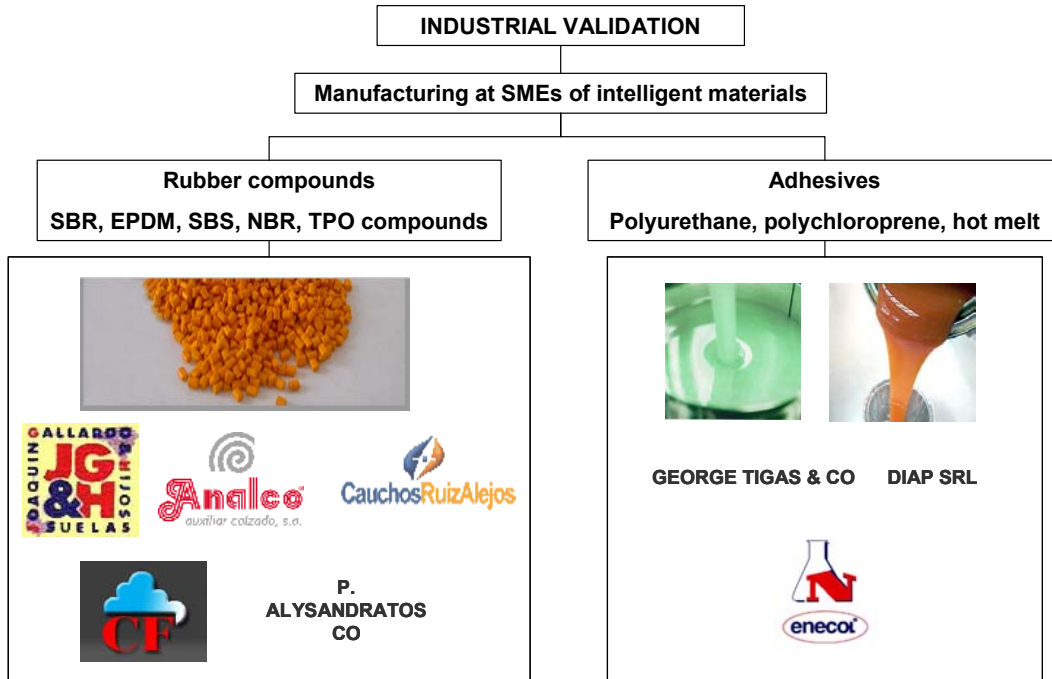


Figure 2

Afterwards, footwear was made using the modified rubber compounds and adhesives. SMEs partners in the project have been in touch with their footwear manufacturer customers so that a wide range of men’s and women’s footwear designs have been manufactured. Footwear manufactured has been subjected to an exhaustive quality control and wearer trials.

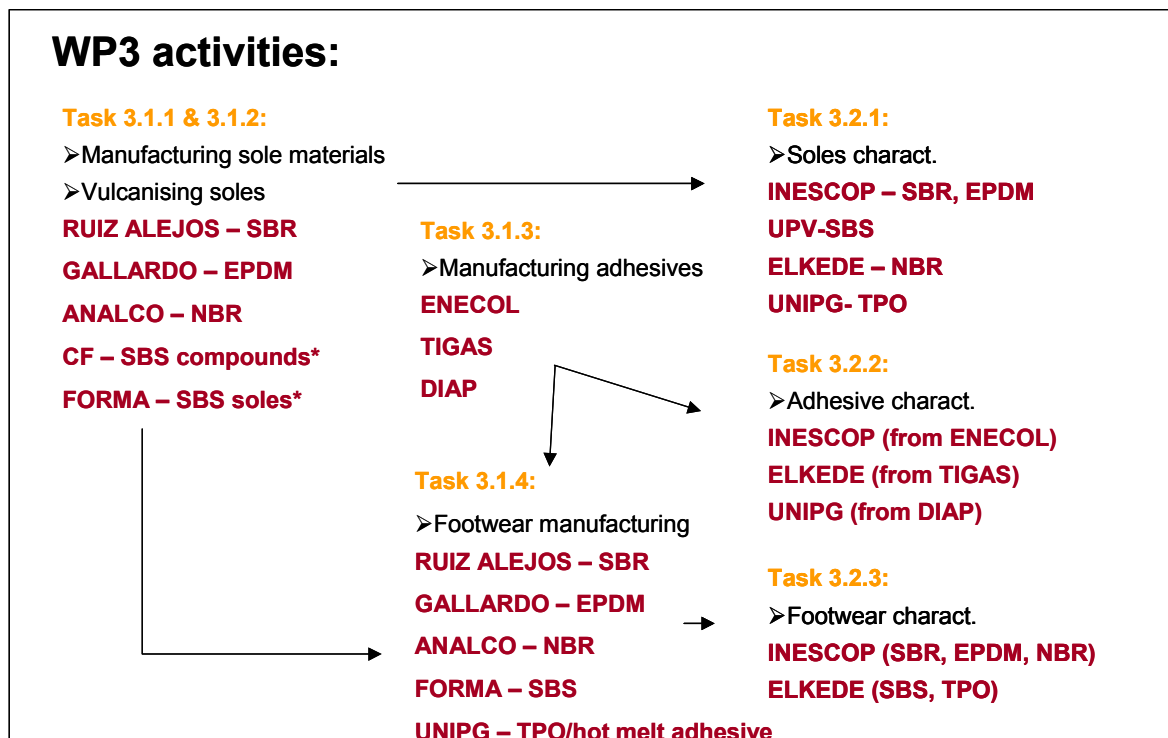


Figure 3

Finally, a final socioeconomic and environmental assessment of the results has been made, both in terms of competitive advantages for rubber and adhesive manufacturers and of shoe end-users.

The main results from this workpackage have been reported at **Deliverable 6**. Finally, different intelligent-multifunctional rubber compounds/adhesive systems have been selected for commercial promotion in WP4 and it has been reported at **Deliverable 7**.

In the workpackage 4 "*Dissemination and exploitation results. Commercial promotion*", several diffusion activities have been carried out in order to introduce the new technology into the footwear sector: seminars, papers, web page, demonstration activities to footwear manufacturers, participation in fairs, etc. A summary of diffusion activities carried out by all partners in the project has been reported at **Deliverable 8**.

On the other hand, options for exploitation arrangements have been discussed at Steering Committee in order to establish "agreement in principle" on specific exploitation measures. A Detailed Plan Agreed by all Partners for Commercial Exploitation of the Results has been reported at **Deliverable 9**.

Moreover, the work produced within WP5 "*Project Management*" was to ensure the execution of the work-programme and the communication inside the consortium, meeting organisation and drafting of reports and minutes. In addition, the INNORUBBER project's Website (<http://innorubber.inescop.es>) has been updated regularly. All the project partners can go to this Website in order to be properly informed about the project development and to find all the deliverables and available documents related to the project.

Next, the work performed per task by each contractor in the project are summarised.

Partner: (1) INESCOP – INSTITUTO TECNOLÓGICO DEL CALZADO Y CONEXAS

WORKPACKAGE	TASK	WORK PERFORMED by INESCOP
1	1.1	(1) Specifications of soling materials. (2) Gathering of SBR, EPDM rubbers from SMEs and moulding of sheets for testing.
	1.2	Characterisation of commercial and standard SBR and EPDM rubber compounds.
	1.3	Obtaining WP1 conclusions and reporting final conclusions. (2) Deliverables 1, 2,3, 11
2	2.1	Modification of EPDM compounds by means of different routes: formulation and polymer blending. Some polar monomers were used as adhesion promoters in order to improve adhesion properties. Modification of SBR rubber compounds by means of formulation with special additives and polymer blending. Optimisation of moulding conditions. Modification of polyurethane adhesive formulations by means of formulation, functionalisation and synthesis. Modification of polychloroprene adhesive formulations by means of formulation with special additives, functionalisation by grafting, polymer blending, etc. Moulding of modified SBR and EPDM rubber compounds sheets for testing.
	2.2	Characterisation of modified EPDM rubber compounds: physical-chemical and mechanical properties have been analysed. Characterisation of SBR rubber compounds: physical-chemical and mechanical properties have been analysed. Characterisation of modified polyurethane adhesives by several experimental techniques: IR, DSC, TG, rheology, etc. Characterisation of modified polychloroprene adhesives by several experimental techniques: IR, DSC, TG, rheology, etc. Characterisation of adhesion properties between SBR and EPDM rubber compounds and modified adhesives (polyurethane and polychloroprene). Supplying modified polyurethane adhesive formulation to each RTD in order to evaluate the adhesion properties with modified rubber compounds.

WORKPACKAGE	TASK	WORK PERFORMED by INESCOPE
	2.3	<p>Obtaining WP2 conclusions about intelligent SBR and EPDM rubber compounds and reporting final conclusions (Deliverable 4).</p> <p>Obtaining WP2 conclusions about intelligent polyurethane and polychloroprene adhesives and reporting final conclusions (Deliverable 4).</p> <p>Selection of intelligent EPDM rubber compound/adhesive systems which comply with the footwear specifications for industrial validation in WP3 (Deliverable 5).</p> <p>Selection of intelligent SBR rubber compound/adhesive systems which comply with the footwear specifications for industrial validation in WP3 (Deliverable 5).</p> <p>Selection of intelligent polyurethane adhesive formulations for industrial validation in WP3 (Deliverable 5).</p> <p>Selection of intelligent polychloroprene adhesive formulations for industrial validation in WP3 (Deliverable 5).</p>
3	3.1	<p>Coordination of manufacturing trials in Spain.</p> <p>A draft planning of industrial trials for EPDM rubber compounds with the partner GALLARDO has been designed and discussed.</p> <p>A draft planning of industrial trials for SBR rubber compounds with the partner ALEJOS has been designed and discussed.</p> <p>A draft planning of industrial trials for NBR rubber compounds with the partner ANALCO has been designed and discussed.</p> <p>A draft planning of industrial trials for polyurethane and polychloroprene adhesive formulations with the partner ENECOL has been designed and discussed.</p> <p>Assistance to GALLARDO, ANALCO and ALEJOS during the manufacture of new SBR, EPDM and NBR rubber compounds.</p> <p>Rheologic characterization of uncured standard and intelligent rubber compounds prepared at the GALLARDO, ANALCO and ALEJOS.</p> <p>Assistance to ENECOL during the manufacture of new polyurethane and polychloroprene adhesive formulations.</p>

WORKPACKAGE	TASK	WORK PERFORMED by INESCOP
	3.2	<p>Characterization of standard and intelligent soles moulded at GALLARDO, ANALCO and ALEJOS. Determination of physical-mechanical properties of the standard and intelligent soles to analyse their suitability.</p> <p>Physical-chemical characterization of new adhesive properties to analyse their suitability. .</p> <p>Adhesion properties between modified adhesive formulations and standard and intelligent rubber compound soles manufactured at SMEs.</p> <p>Assistance to Spanish SMEs during the footwear manufacture using intelligent adhesives (polyurethane and polychloroprene) and rubber compounds (SBR, EPDM and NBR).</p> <p>Quality control on footwear manufactured. Management of wearer trials.</p>
	3.3	<p>Information regarding modified rubber compounds and adhesives and the proposed bonding process, as well as, information regarding the conventional bonding process have been provided to UNIPG for the socio-economic and environmental assessment of the project results.</p>
	3.4	<p>Obtaining WP3 conclusions and reporting final conclusions (Deliverable 6).</p> <p>Selection of SBR, NBR and EPDM formulations for commercial promotion in WP4 (Deliverable 7).</p> <p>Selection of polyurethane and polychloroprene adhesive formulations for commercial promotion in WP4.</p>
4	4.1	<p>Options for exploitation arrangements have been discussed at Steering Committee meetings.</p> <p>Diffusion of the intelligent materials to footwear companies.</p> <p>Other diffusion activities:</p> <ul style="list-style-type: none"> - Web sites: www.inescop.es; www.innorubber.inescop.es - Participation in different footwear fairs: LINEAPELLE (Italy), FURTURMODA (Spain), etc. - Seminars in Spain - Articles - Congress communication <p>Detailed description about diffusion activities carried out by INESCOP are enclosed at Deliverable 8.</p>

WORKPACKAGE	TASK	WORK PERFORMED by INESCOP
	4.2	Detailed Plan Agreed by all partners for commercial exploitation of project results (Deliverable 9). INESCOP acts as exploitation manager.
5	5	<p>Project management: Establishing of follow-up mechanisms, organization of meetings and drafting of reports.</p> <p>Organization and participation in kick-off meeting in Elda on 21/04/04 (Dr. Francisca Arán, Dr. Maria Angeles Pérez, Mr. Norberto Porta, Ms. Cristina Llobell, Mr. Enrique Montiel)</p> <p>Participation in the six months progress meeting in Athens (Greece) on 22/10/04. (Dr. Francisca Arán and Ms. Cristina Llobell)</p> <p>Participation to the Mid Term meeting in Terni (Italy) on 22/04/05 (Dr. Francisca Arán).</p> <p>Participation in the 18 months progress meeting in Valencia on 22/10/05 (Dr. Francisca Arán and Ms. Cristina Llobell).</p> <p>Organization and participation in the final meeting in Elda on 26/04/06 (Dr. Francisca Arán, Dr. Maria Angeles Pérez, Mr. Norberto Porta, Ms. Cristina Llobell, Ms. Maria José Fernández)</p> <p>Preparation of technical reports as contributions for the project Deliverables.</p> <p>Co-ordination at consortium level of the technical activities of the project.</p> <p>Communication with all the project Spanish partners regarding management information.</p> <p>Reporting cost statements for the second period (Form C and an audit certificate).</p> <p>INESCOP acts as project co-ordinator. Detailed description about management activities are enclosed at the 24 months management report.</p>

Partner: (2) GALLARDO – JOAQUIN GALLARDO E HIJOS, S.L.

WORKPACKAGE	TASK	WORK PERFORMED by GALLARDO
1	1.1	Provide commercial SBR and EPDM soling materials (soles and raw materials) and additives and supply to RTDs. Detailed description of the formulations supplied
	1.2	-
	1.3	Collaboration in obtaining WP1 conclusions.
2	2.1	Supplying SBR and EPDM rubber compounds raw materials and additives to INESCOP. Providing technical specifications for SBR and EPDM rubber compounds as soling materials. Several visits and contact with some suppliers of raw materials for rubber compounds in order to obtain the most suitable additives for EPDM rubber modification. Collaboration with INESCOP in the modification of SBR and EPDM rubber compounds in order to improve the compatibility with the adhesive.
	2.3	Collaboration in obtaining WP2 conclusions (Deliverable 4). Selection of modified and standard SBR and EPDM rubber compounds for industrial validation in WP3 (Deliverable 5). Collaboration with INESCOP in selecting the most suitable SBR and EPDM rubber compound/adhesive systems for industrial validation in WP3.
3	3.1	Industrial validation of modified SBR and EPDM compounds: GALLARDO has manufactured in its own factory standard and intelligent SBR and EPDM compounds. Two models of soles for men's and women's footwear have been vulcanised with them. Previously, the adaptation and optimisation of the new SBR and EPDM compounds manufacturing process to his own moulding process were necessary. Several visits to INESCOP in order to solve technical questions about the mixing of intelligent compounds. Contact with the shoemakers to prepare industrial manufacturing of footwear using the intelligent soles of SBR and EPDM. Men's and women's footwear has been manufactured at the company of one of their customers, called PIKOLINOS (Elche, Spain).

WORKPACKAGE	TASK	WORK PERFORMED by GALLARDO
	3.2	GALLARDO provided modified SBR and EPDM soles and detailed information about the manufacturing process to INESCOP for physical-chemical and rheological characterization.
	3.3	GALLARDO provided some information regarding modified SBR and EPDM rubber compounds manufacturing processes and regarding new material costs to INESCOP, as well as, information regarding the conventional processes for the socio-economic and environmental assessment of the project results.
	3.4	Collaboration in obtaining WP3 conclusions (Deliverable 6). Several meetings were held between INESCOP and GALLARDO in order to obtain conclusions and select the most suitable EPDM and SBR rubber formulations for commercial validation in WP4 (Deliverable 7)
4	4.1	Options for exploitation arrangements have been discussed at Steering Committee meetings. Several meetings with special additives suppliers in order to establish competitive prices for footwear sector. Visits to shoemaker companies to promote these new materials and their advantages. Participation in footwear and footwear components fairs. Participation in different footwear fairs: LINEAPELLE (Italy), FURTURMODA (Spain), etc. Detailed description about diffusion activities carried out are enclosed at Deliverable 8.
	4.2	Spanish SMEs rubber partners meetings in order to establish some commercialisation strategies in Spain. Detailed Plan Agreed by all partners for commercial exploitation of project results (Deliverable 9).
5	5	GALLARDO acts as the technical manager of the project. Participation in the kick-off meeting in Elda (Spain) on 21/04/04. Participation in the Final meeting in Elda (Spain) on 26/04/06 (Mr. Manuel Gallardo). Reporting cost statements for the first period (Form C) Reporting cost statements for the second period (Form C). An audit certificate has also been provided.

Partner: (3) ANALCO – ANALCO AUXILIAR DEL CALZADO, S.A.

WORKPACKAGE	TASK	WORK PERFORMED by ANALCO
	1.1	Provide commercial SBR, SBS, NBR soling materials (soles and raw materials) and additives and supply to RTDs. Detailed description of the formulations supplied.
	1.2	-
	1.3	Collaboration in obtaining WP1 conclusions.
2	2.1	<p>Supplying SBR and SBS rubber compounds raw materials and additives to INESCOP and UPV, respectively.</p> <p>Providing technical specifications for SBR and SBS rubber compounds as soling materials.</p> <p>Several visits and contact with some suppliers of raw materials for rubber compounds in order to obtain the most suitable additives for EPDM rubber modification.</p> <p>Collaboration with INESCOP and UPV in the modification of SBR and SBS rubber compounds, respectively, in order to improve the compatibility with the adhesive.</p>
	2.3	<p>Collaboration in obtaining WP2 conclusions (Deliverable 4).</p> <p>Selection of modified and standard SBR and SBS rubber compounds for industrial validation in WP3 (Deliverable 5):</p> <p>Collaboration with INESCOP in selecting the most suitable SBR rubber compound/adhesive systems for industrial validation in WP3.</p> <p>Collaboration with UPV in selecting the most suitable SBS rubber compound/adhesive systems for industrial validation in WP3.</p>

WORKPACKAGE	TASK	WORK PERFORMED by ANALCO
3	3.1	<p>Industrial validation of modified SBR and NBR compounds: ANALCO has manufactured in its own factory standard and intelligent SBR and NBR compounds. Two models of soles for men's and women's footwear have been vulcanised with them.</p> <p>Previously, the adaptation and optimisation of the new SBR and NBR compounds manufacturing process to his own moulding process were necessary.</p> <p>Several visits to INESCOP in order to solve technical questions about the mixing of intelligent compounds.</p> <p>Contact with the shoemakers to prepare industrial manufacturing of footwear using the intelligent soles of SBR and NBR.</p> <p>On the one hand, men's shoes have been manufactured at the company of one of their customers, called KGM (Elche, Spain). On the other hand, women's shoes have been manufactured at the company of another one of their customers, called CALZADOS RUIIMAR (Elche, Spain).</p>
	3.2	ANALCO provided modified SBR and NBR soles and detailed information about the manufacturing process to INESCOP for physical-chemical and rheological characterization.
	3.3	ANALCO provided some information regarding modified SBR and NBR rubber compounds manufacturing processes and regarding new material costs to INESCOP, as well as, information regarding the conventional processes for the socio-economic and environmental assessment of the project results.
	3.4	<p>Collaboration in obtaining WP3 conclusions (Deliverable 6).</p> <p>Several meetings were held between INESCOP and ANALCO in order to obtain conclusions and select the most suitable SBR and NBR rubber formulations for commercial validation in WP4 (Deliverable 7)</p> <p>Detailed information about industrial validation of modified NBR compounds was also sent to ELKEDE.</p>

WORKPACKAGE	TASK	WORK PERFORMED by ANALCO
4	4.1	Options for exploitation arrangements have been discussed at Steering Committee meetings. Several meetings with special additives suppliers in order to establish competitive prices for footwear sector. Visits to shoemaker companies to promote these new materials and their advantages. Participation in footwear and footwear components fairs. Participation in different footwear fairs: LINEAPELLE (Italy), FURTURMODA (Spain), etc. Detailed description about diffusion activities carried out are enclosed at Deliverable 8.
	4.2	Spanish SMEs rubber partners meetings in order to establish some commercialisation strategies in Spain. Detailed Plan Agreed by all partners for commercial exploitation of project results (Deliverable 9).
5	5	Participation in the kick-off meeting in Elda (Spain) on 21/04/04. Participation in the Final meeting in Elda (Spain) on 26/04/06 (Mr. José Ramón Sempere and Mr. Antonio Sanchis). Reporting cost statements for the first period (Form C) Reporting cost statements for the second period (Form C). An audit certificate has also been provided.

Partner: (4) ALEJOS – CAUCHOS RUIZ ALEJOS, S.A.

WORKPACKAGE	TASK	WORK PERFORMED by ALEJOS
1	1.1	Provide commercial SBR and NBR soling materials (soles and raw materials) and additives and supply to RTDs. Detailed description of the formulations supplied
	1.2	-
	1.3	Collaboration in obtaining WP1 conclusions.
2	2.1	Supplying SBR rubber compounds raw materials and additives to INESCOP. Providing technical specifications for SBR rubber compounds as soling materials. Several visits and contact with some suppliers of raw materials for rubber compounds in order to obtain the most suitable additives for EPDM rubber modification. Collaboration with INESCOP in the modification of SBR rubber compounds in order to improve the compatibility with the adhesive.
	2.3	Collaboration in obtaining WP2 conclusions (Deliverable 4). Selection of modified and standard SBR rubber compounds for industrial validation in WP3 (Deliverable 5): Collaboration with INESCOP in selecting the most suitable SBR rubber compound/adhesive systems for industrial validation in WP3.
3	3.1	Industrial validation of modified SBR compounds: ALEJOS has manufactured in his own factory standard and intelligent SBR compounds. One model of sole for men's shoes has been vulcanised with them. Previously, the adaptation and optimisation of the new SBR compounds manufacturing process to his own moulding process were necessary. Several visits to INESCOP in order to solve technical questions about the mixing of intelligent compounds. Contact with the shoemakers to prepare industrial manufacturing of footwear using the intelligent soles of SBR. Men's shoes have been manufactured at the company of one of their customers at PIKOLINOS (Elche, Spain).
	3.2	ALEJOS provided modified SBR soles and detailed information about the manufacturing process to INESCOP for physical-chemical and rheological characterization.

WORKPACKAGE	TASK	WORK PERFORMED by ALEJOS
	3.3	ALEJOS provided some information regarding modified SBR rubber compounds manufacturing processes and regarding new material costs to INESCOP, as well as, information regarding the conventional process for the socio-economic and environmental assessment of the project results.
	3.4	Collaboration in obtaining WP3 conclusions (Deliverable 6). Several meetings were held between INESCOP and ALEJOS in order to obtain conclusions and select the most suitable SBR rubber formulations for commercial validation in WP4 (Deliverable 7).
4	4.1	Options for exploitation arrangements have been discussed at Steering Committee meetings. Several meetings with special additives suppliers in order to establish competitive prices for footwear sector. Visits to shoemaker companies to promote these new materials and their advantages. Participation in different footwear fairs: LINEAPELLE (Italy), FURTURMODA (Spain), etc. Detailed description about diffusion activities carried out are enclosed at Deliverable 8.
	4.2	Spanish SMEs rubber partners meetings in order to establish some commercialisation strategies in Spain. Detailed Plan Agreed by all partners for commercial exploitation of project results (Deliverable 9).
5	5	Participation in the kick-off meeting in Elda (Spain) on 21/04/04. Participation in the 18 months progress meeting in Valencia (Spain) on 22/10/05 (Ms. Marta Calvo). Participation in the Final meeting in Elda (Spain) on 26/04/06 (Mr. José Ramón Sempere and Mr. Antonio Sanchis). Reporting cost statements for the first period (Form C) Reporting cost statements for the second period (Form C). An audit certificate has also been provided.

Partner: (5) ENECOL – ENECOL ADHESIVOS, S.L.

WORKPACKAGE	TASK	WORK PERFORMED by ENECOL
1	1.1	Provide commercial adhesives (polyurethane and polychloroprene) and supply to INESCOP. Detailed description of the adhesive formulations supplied. Several visits to some raw materials for polyurethane and polychloroprene adhesive suppliers.
	1.2	-
	1.3	Collaboration in obtaining WP1 conclusions.
2	2.1	ENECOL supplied raw materials and additives for polyurethane and polychloroprene adhesives to INESCOP. Several visits to some suppliers of raw materials for footwear adhesives in order to obtain the most suitable additives for polyurethane and polychloroprene adhesives. Providing technical specifications for footwear adhesives. Collaboration with INESCOP in the modification of polyurethane and polychloroprene adhesive formulation in order to improve the compatibility with the most common rubber compounds used as soling materials in the shoe industry.
	2.3	Collaboration in obtaining WP2 conclusions (Deliverable 4) Selection of modified and standard polyurethane and polychloroprene adhesives for industrial validation in WP3 (Deliverable 5).
3	3.1	Industrial validation of modified polyurethane and polychloroprene adhesives: ENECOL has manufactured modified and standard polyurethane and polychloroprene adhesive formulations at its facilities. The adhesive formulations have been produced using their own equipment under “near to factory conditions”. Assistance to footwear manufacturing trials in Spain using intelligent rubber soles manufactured by GALLARDO, ANALCO and ALEJOS, as well as, modified adhesives.
	3.2	Modified polyurethane and polychloroprene adhesive formulations were sent to INESCOP for physical-chemical characterization.

WORKPACKAGE	TASK	WORK PERFORMED by ENECOL
	3.3	Data supplied to INESCOP and UNIPG for the evaluation of the socio-economic and environmental impact of the new adhesives in the footwear industry. Furthermore, some information regarding the conventional bonding process was supplied.
	3.4	Collaboration in obtaining WP3 conclusions (Deliverable 6). Selection of polyurethane and polychloroprene adhesive formulations for commercial promotion in WP4 (Deliverable 7).
4	4.1	Options for exploitation arrangements have been discussed at Steering Committee meetings. Several meetings with special additives suppliers in order to establish competitive prices for footwear sector. Diffusion of the intelligent adhesives to footwear companies. Visits to shoemaker companies to promote these new materials and their advantages. Participation in different footwear and footwear components fairs: FURTURMODA (Spain), etc. Detailed description about diffusion activities carried out are enclosed at Deliverable 8.
	4.2	Spanish SMEs rubber partners meetings in order to establish some commercialisation strategies in Spain. Detailed Plan Agreed by all partners for commercial exploitation of project results (Deliverable 9).
5	5	Participation in the kick-off meeting in Elda (Spain) on 21/04/04. Participation in the six months progress meeting in Athens (Greece) on 22/10/04. Participation in the Mid Term meeting in Terni (Italy) on 22/04/05 (Mr. Joaquin Valero). Participation in the 18 months progress meeting in Valencia (Spain) on 22/10/05 (Mr. Joaquin Valero). Participation in the Final meeting in Elda (Spain) on 26/04/06 (Mr. Joaquin Valero). Reporting cost statements for the first period (Form C) Reporting cost statements for the second period (Form C). An audit certificate has also been provided.

Partner: (6) FORMA – P. ALYSANDRATOS & SIA.

WORKPACKAGE	TASK	WORK PERFORMED by FORMA
1	1.1	Provide commercial SBS soling materials (soles and raw materials) and additives and supply to UPV.
	1.2	-
	1.3	Collaboration in obtaining WP1 conclusions.
2	2.1	Supplying NBR rubber compounds raw materials and additives to INESCOP. Providing technical specifications for NBR rubber compounds as soling materials. Several visits and contact with some suppliers of raw materials for rubber compounds in order to obtain the most suitable additives for EPDM rubber modification. Collaboration with INESCOP in the modification of SBR rubber compounds in order to improve the compatibility with the adhesive.
	2.3	Collaboration in obtaining WP2 conclusions (Deliverable 4). Selection of modified and standard SBR rubber compounds for industrial validation in WP3 (Deliverable 5): Collaboration with INESCOP in selecting the most suitable SBR rubber compound/adhesive systems for industrial validation in WP3.
3	3.1	Industrial validation of modified SBR compounds: ALEJOS has manufactured in his own factory standard and intelligent SBR compounds. One model of sole for men's shoes has been vulcanised with them. Previously, the adaptation and optimisation of the new SBR compounds manufacturing process to his own moulding process were necessary. Several visits to INESCOP in order to solve technical questions about the mixing of intelligent compounds. Contact with the shoemakers to prepare industrial manufacturing of footwear using the intelligent soles of SBR. Men's shoes have been manufactured at the company of one of their customers at PIKOLINOS (Elche, Spain).
	3.2	ALEJOS provided modified SBR soles and detailed information about the manufacturing process to INESCOP for physical-chemical and rheological characterization.

WORKPACKAGE	TASK	WORK PERFORMED by FORMA
	3.3	ALEJOS provided some information regarding modified SBR rubber compounds manufacturing processes and regarding new material costs to INESCOP, as well as, information regarding the conventional process for the socio-economic and environmental assessment of the project results.
	3.4	Collaboration in obtaining WP3 conclusions (Deliverable 6). Several meetings were held between INESCOP and ALEJOS in order to obtain conclusions and select the most suitable SBR rubber formulations for commercial validation in WP4 (Deliverable 7).
4	4.1	Options for exploitation arrangements have been discussed at Steering Committee meetings. Several meetings with special additives suppliers in order to establish competitive prices for footwear sector. Visits to shoemaker companies to promote these new materials and their advantages. Participation in footwear and footwear components fairs. Detailed description about diffusion activities carried out are enclosed at Deliverable 8.
	4.2	Greek SMEs rubber and adhesive manufacturer partners meetings in order to establish some commercialisation strategies in Greece. Detailed Plan Agreed by all partners for commercial exploitation of project results (Deliverable 9).
5	5	Participation in the kick-off meeting in Elda (Spain) on 21/04/04. Participation in the six months progress meeting in Athens (Greece) on 21/04/04. Reporting cost statements for the first period (Form C) Reporting cost statements for the second period (Form C). An audit certificate has also been provided.

Partner: (7) TIGAS – GEORGIOS TIGAS & SIA SP.

WORKPACKAGE	TASK	WORK PERFORMED by TIGAS
1	1.1	Provide commercial adhesives (polyurethane and polychloroprene) and supply to INESCOP. Detailed description of the adhesive formulations supplied. Provide a commercial polyurethane adhesive formulation to ELKEDE used as standard adhesive
	1.2	-
	1.3	Collaboration in obtaining WP1 conclusions.
2	2.1	TIGAS supplied raw materials and additives for polyurethane and polychloroprene adhesives to INESCOP and ELKEDE. Several visits to some suppliers of raw materials for footwear adhesives in order to obtain the most suitable additives for polyurethane and polychloroprene adhesives. Providing technical specifications for footwear adhesives. Collaboration with INESCOP in the modification of polyurethane and polychloroprene adhesive formulation in order to improve the compatibility with the most common rubber compounds used as soling materials in the shoe industry.
	2.2	TIGAS has provided polyurethane and polychloroprene adhesives to ELKEDE for T-peel tests carried out.
	2.3	Collaboration in obtaining WP2 conclusions (Deliverable 4) Selection of modified and standard polyurethane and polychloroprene adhesives for industrial validation in WP3 (Deliverable 5).
3	3.1	Industrial validation of modified polyurethane and polychloroprene adhesives: ENECOL has manufactured modified and standard polyurethane and polychloroprene adhesive formulations at its facilities. The adhesive formulations have been produced using their own equipment under “near to factory conditions”. Assistance to footwear manufacturing trials in Spain using intelligent rubber soles manufactured by GALLARDO, ANALCO and ALEJOS, as well as, modified adhesives.
	3.2	Modified polyurethane and polychloroprene adhesive formulations were sent to INESCOP for physical-chemical characterization.

WORKPACKAGE	TASK	WORK PERFORMED by TIGAS
	3.3	Data supplied to INESCOP and UNIPG for the evaluation of the socio-economic and environmental impact of the new adhesives in the footwear industry. Furthermore, some information regarding the conventional bonding process was supplied.
	3.4	Collaboration in obtaining WP3 conclusions (Deliverable 4). Selection of polyurethane and polychloroprene adhesive formulations for commercial promotion in WP4 (Deliverable 5).
4	4.1	Options for exploitation arrangements have been discussed at Steering Committee meetings. Several meetings with special additives suppliers in order to establish competitive prices for footwear sector. Diffusion of the intelligent adhesives to footwear companies. Visits to shoemaker companies to promote these new materials and their advantages. Participation in different footwear fairs Detailed description about diffusion activities carried out are enclosed at Deliverable 8.
	4.2	Spanish SMEs rubber partners meetings in order to establish some commercialisation strategies in Spain. Detailed Plan Agreed by all partners for commercial exploitation of project results (Deliverable 9).
5	5	Participation in the kick-off meeting in Elda (Spain) on 21/04/04. Participation in the six months progress meeting in Athens (Greece) on 22/10/04. Participation in the Final meeting in Elda (Spain) on 26/04/06 (Mr. Eusthatios Tigas). Reporting cost statements for the first period (Form C) Reporting cost statements for the second period (Form C). An audit certificate has also been provided.

Partner: (8) CF – CF SRL.

WORKPACKAGE	TASK	WORK PERFORMED by CF
1	1.1	Provide TPO commercial soling materials (soles and raw materials) and supply to UNIPG.
	1.2	-
	1.3	Collaboration in obtaining WP1 conclusions.
2	2.1	CF supplied TPO raw materials and additives to UNIPG. Collaboration with UNIPG in the modification of TPO compounds to obtain improved adhesion properties using hot-melt and modified polyurethane adhesives sent by INESCOP .
	2.3	Collaboration in obtaining WP2 conclusions (Deliverable 4) Selection of modified and standard TPO compounds for industrial validation in WP3 (Deliverable 5).
3	3.1	CF has prepared in its own plant the modified SBS compound in the quantity able to produce the soles for manufacturing of shoes in Greece. An extrusion process for thermoplastic compounds has been used. Previously, the adaptation and optimisation of the new SBS compound manufacturing process were necessary. Several contacts with UPV and UNIPG in order to solve technical questions about the extrusion process conditions of the SBS intelligent compounds. According to the specification of industrial trials, samples of the modified formulations were sent to the Polytechnic University of Valencia in order to optimise the processing conditions.
	3.2	Modified SBS rubber compounds were sent to ELKEDE and UPV for physical-chemical characterization.
	3.3	CF provided detailed information about the manufacturing process to UNIPG for socio-economic and environmental impact assessment.
	3.4	Collaboration in obtaining WP3 conclusions (Deliverable 6). Several meetings were held between UPV, ELKEDE, UNIPG, CF and FORMA in order to obtain conclusions and select the most suitable SBS rubber formulations for commercial validation in WP4 (Deliverable 7).

WORKPACKAGE	TASK	WORK PERFORMED by CF
4	4.1	Options for exploitation arrangements have been discussed at Steering Committee meetings. Several meetings with special additives suppliers in order to establish competitive prices for footwear sector. Participation in different footwear fairs Detailed description about diffusion activities carried out are enclosed at Deliverable 8.
	4.2	Spanish SMEs rubber partners meetings in order to establish some commercialisation strategies in Spain. Detailed Plan Agreed by all partners for commercial exploitation of project results (Deliverable 9).
5	5	Participation in the mid-term meeting in Terni (Italy) on 22/04/05. Participation to the Mid Term meeting in Terni (Italy) on 22/04/05 (Mr. Bruno Constantini). Participation in the 18 months progress meeting in Valencia (Spain) on 22/10/05 (Mr. Constantini Bruno). Participation in the Final meeting in Elda (Spain) on 26/04/06 (Mr. Constantini Bruno). Reporting cost statements for the first period (Form C) Reporting cost statements for the second period (Form C).). An audit certificate has also been provided.

Partner: (9) DIAP – DIAP SRL.

WORKPACKAGE	TASK	WORK PERFORMED by DIAP
1	1.1	Provide their hot-melt adhesive formulations to INESCOP and UNIPG for testing. Provide to UNIPG a hot-melt application machine.
	1.2	-
	1.3	Collaboration in obtaining WP1 conclusions
2	2.1	DIAP provided their hot-melt adhesive formulations and additives to UNIPG for testing and also a hot-melt application machine. Providing technical specifications for hot-melt adhesives. Collaboration with UNIPG in the modification of hot-melt adhesive formulation in order to improve the compatibility with the most common TPO compounds for the shoe industry.
	2.3	Collaboration in obtaining WP2 conclusions (Deliverable 4) Selection of modified and standard hot-melt adhesives and TPO compounds for industrial validation in WP3 (Deliverable 5).
3	3.1	Industrial validation of modified TPO compounds/hot-melt adhesives systems: DIAP manufactured modified hot-melt adhesive formulations at its facilities. Assistance to footwear manufacturing trials in Italy using intelligent TPO soles and modified hot-melt adhesives. Furthermore, DIAP provided the mould and the specific equipment for the assembling of the shoe with the aid of the robot.
	3.2	Modified hot-melt adhesive formulations were sent to UNIPG for physical-chemical characterization.
	3.3	Data supplied to INESCOP and UNIPG for the evaluation of the socio-economic and environmental impact of the new adhesives in the footwear industry. Furthermore, some information regarding the conventional bonding process was supplied.

WORKPACKAGE	TASK	WORK PERFORMED by DIAP
	3.4	Collaboration in obtaining WP3 conclusions (Deliverable 6). Selection of TPO compounds/hot-melt adhesive systems for commercial promotion in WP4 (Deliverable 7).
4	4.1	Options for exploitation arrangements have been discussed at Steering Committee meetings. Participation in different footwear fairs Detailed description about diffusion activities carried out are enclosed at Deliverable 8.
	4.2	Italian SMEs partners meetings in order to establish some commercialisation strategies in Italy. Detailed Plan Agreed by all partners for commercial exploitation of project results (Deliverable 9).
5	5	Participation in the kick-off meeting in Elda (Spain) on 21/04/04. Participation in the mid-term meeting in Terni (Italy) on 22/04/05. Participation in the Mid Term meeting in Terni (Italy) on 22/04/05 (Ms. Paola Ottaviani and Mr. Gino Ottaviani). Participation in the Final meeting in Elda (Spain) on 26/04/06 (Ms. Paola Ottaviani and Mr. Vitacoli Fabrizio). Reporting cost statements for the first period (Form C) Reporting cost statements for the second period (Form C).). An audit certificate has also been provided.

Partner: (10) UPV – UNIVERSITY POLYTECHNIC OF VALENCIA

WORKPACKAGE	TASK	WORK PERFORMED by UPV
1	1.1	Gathering of thermoplastic rubbers (SBS) from SMEs and moulding of sheets for testing. Five thermoplastic rubber samples based on SBS, triblock copolymer Two standard formulations were prepared in the UPV laboratory
	1.2	Determination of the average properties of commercial thermoplastics to be used as reference for the modified materials developed in this project. Characterization of the properties of the standard materials to confirm that they are in the order of those of the commercial products.
	1.3	Obtaining WP1 conclusions and reporting UPV conclusions to the co-ordinator. A standard SBS/HIPS rubber compound was selected for WP2 after studying the correlation between adhesion and physico-chemical properties of the blends
2	2.1	In order to improve the adhesion properties of the standard rubber compound based on SBS two different synthetic routines has been employed: a. Substitution of HIPS part added to SBS by polystyrene functionalised with maleic anhydride, PSMA, to include polar groups. b. Functionalisation of SBS by maleic anhydride grafting. The results obtained in this task were included in Deliverable 4.
	2.2	To characterize the different modified rubber compounds, contact angle, mechanical properties, Fourier transform infrared spectroscopy, FTIR-ATR, Dynamical Mechanical Analysis (DMA), Transmission Electron Microscopy and T-peel strength were measured. The results obtained in this task were included in Deliverable 4.
	2.3	Collaboration in obtaining WP2 conclusions (Deliverable 4) As a consequence of the results obtained in task 2.2, a blend of an oil extended SBS and a styrene-maleic anhydride copolymer, including antioxidant is selected for industrial validation in WP3 (Deliverable 5).
3	3.1	A draft planning of industrial trials for SBS rubber compounds with the partners FORMA and CF were designed and discussed. The group of the UPV has supplied the components of the intelligent rubber compound based on SBS to DIAP who prepared the pelletized compound. A part of this material was sent back to the UPV and processed in a twin screw extruder in the form of sheets. Another part was sent to FORMA who prepared the injected soles used to fabricate shoes. Some of these shoes were also sent back to the UPV for characterization.

WORKPACKAGE	TASK	WORK PERFORMED by UPV
	3.2	Different properties of the material prepared by industrial means were characterized and compared with those of the compound prepared at the laboratory: mechanical ultimate properties, dynamic-mechanical properties, adhesion forces, surface tension, surface chemistry. It was determined that the adhesive capacity of the anhydride groups included in the formulation of the new adhesive.
	3.3	The UPV group supplied some data on the prices of the components of the SBS based compounds to UNIPG for socio-economic impact assessment of the project results.
	3.4	The results of these experiments and the conclusions reached are included in Deliverable 6. Selection of SBS rubber compounds for commercial promotion in WP4 (Deliverable 7).
4	4.1	Options for exploitation arrangements have been discussed at Steering Committee meetings. An announcement of the project will be included in the web page of the UPV. Detailed description about diffusion activities carried out are enclosed at Deliverable 8.
	4.2	Detailed Plan Agreed by all partners for commercial exploitation of project results (Deliverable 9).
5	5	Participation in the kick-off meeting in Elda (Spain) on 21/04/04. Participation in the six months progress meeting in Athens (Greece) on 21/04/04. Participation in the mid-term meeting in Terni (Italy) on 22/04/05 (Prof. José Luis Gómez Ribelles) Organization and participation in the 18 months progress meeting in Valencia (Spain) on 22/10/05 (Prof. José Luis Gómez Ribelles, Ms. Amparo Baiget Orts, Ms. Dunia Mercedes Garcia). Participation in the Final meeting in Elda (Spain) on 26/04/06 (Prof. José Luis Gómez Ribelles, Ms. Amparo Baiget Orts, Ms. Dunia Mercedes Garcia). Preparation of technical reports as contribution for the project Deliverables. Reporting cost statements for the first period (Form C). Reporting cost statements for the second period (Form C). An audit certificate has also been provided.

Partner: (11) ELKEDE - ELKEDE TECHNOLOGY AND DESIGN CENTRE SA

WORKPACKAGE	TASK	WORK PERFORMED by ELKEDE
1	1.1	Gathering of SMEs soling materials (vulcanised rubbers) and moulding of sheets for testing: Three different commercial rubbers were vulcanized A standard formula of NBR material was selected and sheets for testing were manufactured.
	1.2	standard vulcanised rubbers characterization: Physical-Chemical Characterization for four different materials was performed according the methods described in the task 1.2. Adhesion properties were measured for the four samples. T- peel tests were performed with treated and untreated materials.
	1.3	Obtaining WP1 conclusions. Reporting ELKEDE conclusions to Co-ordinator: The results from the tests were reported and the selection of the material to be modified in the following work package was done.
2	2.1	Vulcanised NBR rubbers modification. Optimisation conditions and compression moulding of rubber sheets for testing: Three different modifications were performed using additives that were expected to increase the adhesion properties of the material: some natural resins, different amounts of one polybutadiene grafted with maleic anhydride. The parameters for the vulcanisation were measured.
	2.2	Characterisation of modified vulcanised rubber compounds: Physical-Chemical Characterization for the modified materials was performed according to the methods described in Task 2.1. Adhesion properties were measured using standard and modified polyurethane adhesive (from INESCOP) T- peel tests were performed with treated and untreated materials.
	2.3	The results from the tests were reported and the selection of the material for the industrial evaluation was done.

WORKPACKAGE	TASK	WORK PERFORMED by ELKEDE
3	3.1	<p>Coordination of manufacturing trials in Greece.</p> <p>A draft planning of industrial trials for NBR rubber compounds with the partner ANALCO were designed and discussed.</p> <p>Assistance to FORMA during the manufacture of new SBS rubber compound soles.</p> <p>Assistance to TIGAS during the manufacture of the new polychloroprene adhesive formulation.</p> <p>Assistance to Greek SMEs during the footwear manufacture using intelligent adhesives (polychloroprene) and SBS soles.</p>
	3.2	<p>Characterization of NBR soles and TPO men's and women's soles.</p> <p>Preparation of specimens and performance of tests: hardness, density, abrasion resistance, tensile strength, elongation at break, flexing resistance of sole.</p> <p>Performance of peel tests upper to sole at SBS women and men's innovative shoes and TPO women and men's innovative shoes.</p> <p>Performance of peel tests upper to sole at SBS women and men's conventional shoes for comparison.</p> <p>Management of wearer trials.</p>
	3.3	<p>Provide information about the environmental impact of reagents used in the shoe industry and the shoes production cost.</p> <p>Provide information about energy consumption during the procedure of manufacturing shoes.</p>
	3.4	<p>Provide information about the industrial evaluation of results obtained by the tests carried out for SBS soles.</p> <p>Obtaining WP3 conclusions and reporting final conclusions to INESCOP (Deliverable 6).</p> <p>Selection of the most suitable SBS compounds for commercial promotion in WP4 (Deliverable 7).</p>
4	4.1	<p>Provide information about the project on the website of our institute ELKEDE.</p> <p>Arrangement of events in Athens and Thessaloniki where representatives of footwear sector were invited and informed about the Innorubber project.</p> <p>Provide information about the project to Clients from the footwear sector, who use the services of the laboratory of ELKEDE.</p> <p>Publication of article about Innorubber in a Greek magazine related to footwear.</p>

WORKPACKAGE	TASK	WORK PERFORMED by ELKEDE
	4.2	Detailed Plan Agreed by all partners for commercial exploitation of project results (Deliverable 9).
5	5	<p>Participation in the kick-off meeting in Elda (Spain) on 21/04/04.</p> <p>Participation and organization of the six months progress meeting in Athens (Greece) on 22/10/04.</p> <p>Participation in the Mid Term meeting in Terni (Italy) on 22/04/05.</p> <p>Participation in the 18 months progress meeting in Valencia (Spain) on 21/10/05.</p> <p>Communication with Greek SMEs and Project RTDs for the research activities described in DoW.</p> <p>Preparation of technical reports as contributions for the project Deliverables.</p> <p>Participation in the Final meeting in Elda (Spain) on 26/04/06.</p> <p>Reporting cost statements for the first period (Form C)</p> <p>Reporting cost statements for the second reporting period (Form C). An audit certificate has also been provided.</p>

Partner: (12) UNIPG – UNIVERSITY POLYTECHNIC OF PERUGIA

WORKPACKAGE	TASK	WORK PERFORMED by UNIPG
1	1.1	Gathering of TPO compounds from SMEs and moulding of sheets for testing
	1.2	Characterisation of commercial and standard TPO compounds.
	1.3	Obtaining WP1 conclusions and reporting UNIPG conclusions to the co-ordinator
2	2.1	TPO compounds modification: different amounts of a grafted maleic anhydride polypropylene as a coupling agent have been used. Adhesion properties were obtained through two modified polyurethane adhesives from INESCOP and a SBES based hot melt adhesive from DIAP. Optimisation conditions and compression moulding of material sheets for testing.
	2.2	Physical chemical characterisation of modified TPO compounds and hot melt adhesives.
	2.3	Any TPO compound could be selected on the basis of soling materials specifications for industrial trials in WP3. Nevertheless, Italian SMEs were interested in the industrial validation of TPO compounds/hot melt adhesive systems, due to the fact that it was an innovative assembly technique.
3	3.1	Coordination of manufacturing trials in Italy. Assistance to DIAP during the manufacture of new TPO compound soles and hot melt adhesives. Assistance to Italian SMEs during the footwear manufacture using TPO compound soles/hot-melt adhesive systems.
	3.2	Determination of physical-mechanical properties of the standard and intelligent soles to analyse their suitability. Characterization of hot-melt adhesives prepared by DIAP. Footwear manufactured was sent to ELKEDE for quality control.
	3.3	UNIPG has prepared the final socio economical and environmental assessment of the research results, both in terms of competitive advantages for rubber/adhesive manufacturers and of shoe end-users. (Deliverable 6) .

WORKPACKAGE	TASK	WORK PERFORMED by UNIPG
	3.4	<p>Provide information about the industrial evaluation of results obtained by the tests carried out for TPO compounds and hot melt adhesives.</p> <p>Obtaining WP3 conclusions and reporting final conclusions to INESCOP (Deliverable 6).</p> <p>Selection of the most suitable TPO compounds/hot melt adhesive systems for commercial promotion in WP4 (Deliverable 7).</p>
4	4.1	<p>UNIPG has contributed in the exploitation phase supporting training actions and providing technical assistance to further modifications, adjustments or improvements.</p> <p>The scientific achievements will be disseminated by University of Perugia, through papers in scientific magazines. Due to the fact that the results from this research will be interesting not only to the footwear sector, but also to other sectors which are significantly important for the EU industry, it is foreseen that the dissemination of results will extend, not only over the participating countries, but also to the whole European Union through direct actions towards specific categories and the help of Innovation Relay Centres.</p>
	4.2	Detailed Plan Agreed by all partners for commercial exploitation of project results (Deliverable 9).
5	5	<p>Participation in the kick-off meeting in Elda (Spain) on 21/04/04.</p> <p>Participation in the six months progress meeting in Athens (Greece) on 22/10/04.</p> <p>Organization and participation of the mid-term meeting in Terni (Italy) on 22/04/05.</p> <p>Participation in the 18 months progress meeting in Valencia (Spain) on 21/10/05.</p> <p>Participation in the Final meeting in Elda (Spain) on 26/04/06.</p> <p>Management information communication with all the Italian partners.</p> <p>Preparation of technical reports as contributions for the project Deliverables.</p> <p>Reporting cost statements for the first period (Form C) Forma and technical reports provided to the co-ordinator.</p> <p>Reporting cost statements for the second reporting period (Form C). An audit certificate has also been provided.</p>

1.3. Problems during the reporting period.

No relevant problems have been encountered in the whole period of the project, except those related to the delay in gathering commercial raw materials. This fact can be considered "frequent".

Only a postponement for the justification of the last period of the above mentioned project, with regards to the deadline established in the contract was requested. According to the contract, the deadline for the justification of the last project period was 15th May, and it was postponed until 31st May 2006. The request for the postponement was mainly due to the delay in the preparation of the audit certificates for the external auditors of some project partners.

2. Workpackage progress of the period.

2.1. Workpackage objectives and starting point of work at the beginning of reporting period.

The specific objectives for the relevant period can be divided into three workpackages:

WP1. State-of-the-art and technical limitations.

Objectives

1. Benchmarking with bonding systems currently used by leading footwear manufacturers worldwide were prepared. According to this information, the rubbers most frequently used in the footwear industry as soling materials (vulcanised and thermoplastic rubbers), and the most common adhesives, mainly polyurethane and polychloroprene adhesives, and their standard formulations were selected.

2. Determining the rubber compounds and adhesives properties which influence the compatibility rubber-adhesive, and thus the adhesion phenomena.

Selection of rubber compounds and adhesives that comply with the footwear specifications and comparison with the properties of standard rubbers prepared at laboratory.

3. Finally, a selection of possible rubber compounds and corresponding adhesives were carried out in order to be modified in WP2.

Starting point of work in WP1 at beginning of the project

Rubber compounds and adhesives studied were selected among those commonly used in footwear industry. At the beginning of the project, considering the commercial materials made available by the SME partners, a total of 21 rubber compounds (commercial and standard) were defined to ensure different final intended uses and different polymer bases (EPDM, SBR, SBS, NBR and TPO). Regarding the adhesives, they were selected among those commonly used for bonding the commercial materials supplied to uppers, mainly polychloroprene and polyurethane adhesives.

In this work-package, RTD partners in the project have worked complementarily as each one has gathered and tested different materials supplied by the SME partners in the project.

WP 2. Development of intelligent-multifunctional materials (rubbers and adhesives) in order to be bonded without or with the minimum surface treatment.

Objectives

1. Modification of rubber compounds and corresponding adhesives to improve adhesion properties and provide “intelligent-multifunctional materials” with optimised properties for bonding footwear materials under acceptable process conditions. These materials must be different concerning their polymeric nature in order to be representative of those materials used in the footwear industry.
2. Physical-chemical characterization of modified materials (rubber compounds and adhesives) in order to analyse their suitability.
3. Selection of rubber compounds – adhesive systems for industrial validation.

Starting point of work in WP2 at beginning of the project

On the one hand, the starting point of work in this workpackage at the beginning of the project was a preliminary search through space-net patent databases system, scientific and technical databases, etc and also the experience of the partners in the material science and technology.

On the other hand, the rubber compounds and adhesives selected in WP1 including possible routes of modification proposed (formulation, functionalisation, polymer blending, synthesis, etc) have been the starting point of work. In this work-package, the RTD partners have worked complementarily as each one of them has modified and tested different materials (SBR, EPDM, SBS and TPO rubber compounds and PU and PC adhesives).

According to established footwear requirements, modified rubber compounds and adhesives have been selected with physical-chemical properties similar to those used currently in the footwear industry. The properties of the current footwear materials, soling materials and adhesives, were assessed during the work carried out in the first workpackage.

WP 3. Industrial validation of intelligent-multifunctional materials.

Objectives

1. Industrial validation of the new materials developed in a previous task from the point of view of the adaptation of new materials to SMEs mixing processes.
2. The innovative assembly process (intelligent rubber compounds and adhesives) should prove if it is practical for use in footwear factories and demonstrate that the footwear produced meets the required standards.

Starting point of work in WP3 at beginning of the project

The modified rubber compounds and adhesives selected at the end of the WP2 have been the starting point of the work. In this work-package, the RTD and SMEs partners have worked complementarily in order to carry out the industrial validation of modified rubber compounds (SBR, EPDM, SBS and NBR) and adhesives (polyurethane, polychloroprene and hot melt adhesives).

Rubber compounds selected have been prepared at SMEs using their own mixing equipment, as well as, the adhesive formulations selected.

After the quality control of the soles and adhesives prepared, several models for men's and women's shoes were manufactured using the new materials. Quality control on footwear has been based on the determination of upper-to-sole resistance and wearer trials.

A final socio-economical and environmental assessment of the project results has been made, both in terms of competitive advantages for rubber/adhesive manufactures and of shoe-end users. In this point, INESCOP as devoted research centre for footwear, has supplied most of the information regarding conventional bonding processes used currently in the footwear industry. Furthermore, the presence of RTD representatives to the real-scale tests and exchange of information between all partners have had crucial value for the success of this task.

WP 4. Dissemination and exploitation of results. Commercial promotion.

Objectives

1. Diffusion of the intelligent materials to companies to the footwear sector.
2. Industrial exploitation assessment.

Starting point of work in WP4 at beginning of the project

The modified rubber compounds and adhesives selected at the end of the WP3 have been the starting point of the work in this workpackage. RTD and SMEs partners have undertaken several diffusion activities have been carried out in order to close the new technology to the footwear sector: seminars, papers, web page, demonstration activities to footwear manufacturers, participation in fairs, etc

With regards to commercial promotion, during the first year of the project a draft detailed plan agreed by all partners for commercial exploitation was prepared. The final document has already been prepared.

WP 5. Project Management.

Objectives

The objectives of the project management during the first year of the project are related to the co-ordination of the project, including the monitoring of the technical progress, the periodic reports and cost statements. Those objectives include the establishment of a good communication flow and the control and planning of the project.

Detailed information about the running of the project has been enclosed in the periodic and the final management reports.

2.2. Progress towards objectives – tasks worked on. Achievements.

Tasks worked on	Progress towards objectives (developed/to be developed)	Achievements	Contractors involved
Task 1.1. Gathering of commercial and standard rubber compounds and adhesives. Moulding of rubber compounds gathered.	100 – 100 %	Benchmarking with bonding systems currently used by leading footwear manufacturers worldwide was prepared in order to select the materials most frequently used in the footwear industry. Gathering of commercial (19 rubber compounds and 9 adhesive formulations) and standard (6 rubber compounds and 3 adhesive formulations) materials.	All partners
Task 1.2. Physical-chemical characterization of rubber compounds and adhesives. Study of adhesion properties between rubber compounds and adhesives.	100 – 100 %	Determination of the rubber compounds and adhesive properties which influence the compatibility rubber-adhesive, and thus the adhesion phenomena. Selection of rubber compounds and adhesives which comply with the footwear specifications and comparison with the standard materials prepared in the laboratories. A test protocol was prepared by the coordinator including the experimental methodology to be used in this task. Deliverables 1 and 11.	All RTD centres
Task 1.3. Correlation of rubber compounds and adhesives physical-chemical properties and adhesion properties. Selection of the most suitable rubber compounds and adhesives to be modified in the WP2.	100 – 100 %	A correlation between physical-chemical properties of rubber compounds and adhesives and their compatibility in order to obtain good adhesion behaviour. Selection of rubber compounds for WP2 including possible routes of modification proposed. Selection of adhesive formulations for WP2 including possible routes of modification proposed. Milestone 1. Deliverables 2 and 3.	All partners
Task 2.1. Modification of rubber compounds and adhesives selected in WP1 to improve adhesion properties. Modification of polymeric materials in order to pre-activate sites by means of formulation, polymer blending, functionalisation, synthesis, etc.	100 %	Modified rubber compound formulations (EPDM, SBR, SBS and NBR) with improved adhesion properties. Modified adhesive formulations (polyurethane, polychloroprene and hot melt) with high compatibility with rubber compounds used as soling materials.	All RTD centres
Task 2.2. Modified rubber compounds and adhesives characterisation has been carried out in order to analyse the suitability of the new materials developed as soling materials or adhesive formulations for footwear.	100 %	Some modified rubber compounds and adhesive formulations have similar physical properties but different-chemical properties compared to those currently used in the footwear industry. Deliverable 4.	All RTD centres
Task 2.3. Different intelligent and multifunctional rubber compounds/adhesives systems have been selected for industrial validation in WP3.	100 %	Different rubber compound/adhesive systems, which comply with the footwear specifications and where the surface treatment prior to bonding have been avoided, roughened and halogenated, were available. In other cases, only the chemical treatment (halogenation) or UV treatment was avoided because a roughened treatment is necessary in order to obtain adequate green strength. Selection of rubber compounds for WP2 including possible routes of modification	All partners in the project, RTDs and SMEs

		proposed. Selection of adhesive formulations for WP2 including possible routes of modification proposed. Milestone 2. Deliverable 5.	
Task 3.1. Manufacturing at SMEs of intelligent materials.	100%	A planning of industrial trials has been designed and discussed. Several models of men's and women's footwear soles have been moulded using conventional mixing processes with slight modifications. Intelligent adhesives formulations have been prepared using conventional manufacturing process at SMEs, with slight modifications. Several models of men's and women's shoes have been manufactured by means of conventional processes but without surface treatments prior to bonding process.r	All partners in the project, RTDs and SMEs
Task 3.2. Control test on footwear	100%	Footwear manufactured using intelligent materials complied with footwear requirements about upper-to-sole resistance.	All partners in the project, RTDs and SMEs
Task 3.3. Socio-economical and environmental impact of the project	100%	Evaluation of the socio-economic impact of the proposed bonding upper-to-sole processes in the footwear industry. Costs of the new rubber compound and adhesives have been calculated.	All partners in the project, RTDs and SMEs
Task 3.4. Conclusions.	100%	Several new rubber compounds (SBR, NBR and EPDM) and new adhesives (based on polyurethane, polychloroprene and polypropylene) have been selected for commercial promotion. Deliverable 6. Deliverable 7. Milestone 3.	All partners in the project, RTDs and SMEs
Task 4.1. Dissemination and exploitation of results.	100%	Diffusion of project results to European footwear companies, mainly from Spain, Italy and Greece. Project web site Seminars Paper 1 Communication to an international congress Deliverable 8	All partners in the project, RTDs and SMEs
Task 4.2. Commercial promotion.	100%	Detailed Plan agreed by all partners for commercial promotion of project results. Deliverable 9	All partners in the project, RTDs and SMEs
Task 5. Project management.	100 %	Project management. Adequate execution of the work programme. Mid term review reports approved without further recommendations. Deliverable 14 Final reports Deliverable 10. Deliverable 12 Deliverable 13	All partners participated and INESCOP was the responsible as project co-ordinator

Table 10 summarises the total person-month for every task and partner, for the whole period of the project, from 1st April 2004 to 31st March 2006.

Table 2. Person-months per task for this reporting period.

PARTNER	Person-months													TOTAL
	Task 1.1	Task 1.2	Task 1.3	Task 2.1	Task 2.2	Task 2.3	Task 3.1	Task 3.2	Task 3.3	Task 3.4	Task 4.1	Task 4.2	Task 5	
(1) INESCOPI	0,45	2,20	1,45	5,00	6,20	1,50	0,90	1,70	1,20	1,50	0,28	0,25	4,30	26,93
(2) GALLARDO	2,10	0,00	0,45	1,18	0,00	0,20	3,50	0,15	0,40	0,50	0,15	0,20	3,00	11,83
(3) ANALCO	2,35	0,00	0,35	1,45	0,00	0,25	3,97	0,18	0,45	0,55	0,20	0,25	2,83	12,83
(4) ALEJOS	2,40	0,00	0,35	1,50	0,00	0,30	4,05	0,20	0,45	0,50	0,20	0,15	2,28	12,38
(5) ENECOL	3,50	0,00	1,50	4,42	0,00	0,30	5,95	0,35	0,55	0,65	0,70	0,30	3,04	21,26
(6) FORMA	2,33	0,00	4,27	3,12	0,00	0,30	6,21	0,00	0,50	0,60	0,20	0,20	2,50	20,23
(7) TIGAS	1,60	0,00	2,27	2,39	0,00	0,30	4,56	0,00	0,50	0,60	0,20	0,20	2,69	15,31
(8) CF	1,20	0,00	0,40	1,30	0,00	0,30	3,70	0,00	0,50	0,50	0,20	0,20	2,50	10,80
(9) DIAP	2,60	0,00	1,20	2,20	0,00	0,20	2,50	0,00	0,40	0,35	0,15	0,20	1,60	11,40
(10) UPV	1,00	1,80	1,40	6,40	5,00	0,30	1,10	2,10	0,50	1,10	0,60	0,00	2,40	23,70
(11) ELKEDE	0,50	1,00	0,60	3,21	3,39	0,30	0,80	1,00	0,40	0,40	0,30	0,30	2,50	14,70
(12) UNIPG	1,65	2,00	1,70	6,20	5,75	0,30	2,10	0,50	2,50	1,50	0,30	0,30	2,30	27,10

2.3. Deviations from the project work-programme.

There are not significant deviations from the work-programme during the reporting period.

2.4. List of Deliverables.

Del. n°	Deliverable name	Workpackage n°	Due date	Actual/Forecast delivery date	Estimated indicative person-months	Used indicative person-months	Lead contractor
1	Report of state-of-the-art (WP1 results)	1	6	8	27.5	27.81	INESCOP
2	Selection of rubber compounds for WP2 including route of modification proposed in order to avoid the surface treatment.	1	9	10	3.7	6.93	INESCOP
3	Selection of adhesive formulations for WP2 including route of modification proposed in order to avoid the surface treatment.	1		10	3.7	6.93	INESCOP
11	Project summary report.	5	6	8	0.5	0.55	INESCOP
14	Mid-term review report	5	12	12	7.0	8.50	INESCOP
4	Report of intelligent materials developed (WP2 results)	2	19	20	54.9	56.50	UPV
5	Selection of rubber compounds – adhesives systems for industrial validation in WP3.	2	19	20	3.6	3.80	INESCOP
6	Report of industrial validation (WP3 results)	3	22	26	52.4	57.28	ANALCO
7	Selection of rubber compound – adhesive systems for commercial promotion.	3	22	26	6.8	7.10	ANALCO
8	Summary of diffusion activities carried out	4	24	26	2.8	2.90	GALLARDO
9	Detailed plan agreed by all partners for commercial promotion	5	24	26	2.8	3.10	GALLARDO
10	Management tools (project calendar, reporting, cost follow up, etc.)	5	24	26	12.6	13.4	INESCOP
12	Project quality indicator	5	24	26	5.0	5.57	INESCOP
13	Milestone report	5	24	26	7.5	8.10	INESCOP

2.5. List of Milestones

Milestone n°	Milestone name	Workpackage n°	Date due	Actual/Forecast delivery date	Lead contractor
1	Establishing a correlation between rubber physical-chemical properties and adhesion properties	1	9	Month 10	INESCOP
2	Eliminating or reducing at maximum the surface treatment in rubber bonding at laboratory level	2	Month 18	Month 19	INESCOP
3	Industrial validation of the intelligent-multifunctional materials (rubber compounds and adhesives)	3, 4	Month 24	Month 26	INESCOP
4	Mid term assessment	all	Month 12	Month 16	INESCOP

3. Consortium management.

3.1. Consortium management tasks.

Project management and co-ordination activities are aimed at ensuring an efficient control and planning of the different tasks. These activities are carried out throughout the project and include both its technical and financial management.

The consortium management tasks carried out during the whole period of the project include:

- Co-ordination at consortium level of the technical activities of the project.
- Follow-up of the activities developed by each project partner.
- The overall legal, contractual, ethical, financial and administrative management of the consortium;
- Preparing, updating and managing the consortium agreement (before the contract signature) between the participants;
- Co-ordination at consortium level of knowledge management and other innovation-related activities;
- Amendments to the contract;
- Report the European Commission about all the activities carried out during the period.
- Monitoring of the deliverables to be sent to the European Commission.
- Distribution of the 1st and 2nd pre-financing payments
- Obtaining cost statements from every participant.
- Organisation and drafting of the minutes from the meetings.

Planning and control is supported by the co-ordinator with the help of standard PC-tools and formal project management techniques. A Website supports the project documentation exchange (www.innorubber.inescop.es) which is regularly updated. The contents of this Website are the following:

- Project outline
- Project partners, including their logo as well as a link to their Website
- Documents
- Private access. Each partner has a login and password.

The private access includes the most relevant documents of the INNORUBBER project: contract documents, deliverables, periodic reports, templates, minutes from the meetings, etc.

The tools used for daily communication and information exchange are computer links, since all the participating institutions can access the internet. The standards used for document preparation are Microsoft Word and Excel.

3.2. Co-ordination activities.

Six main project meetings have been held corresponding to the project:

- Technical meeting on the 21st of April 2004 at INESCOP-Elda (Spain) between INESCOP, UPV, ELKEDE and UNIPG. Kick-off meeting on the 21st April 2004 at INESCOP – Elda (Spain).
- Six-months progress meeting on the 22nd October 2004 at ELKEDE – Athens (Greece)
- Mid-term progress meeting on the 22nd April 2005 at University of Perugia - Terni (Italy).
- 18 months progress meeting on the 21st October 2005 at UPV-Valencia (Spain).
- Final meeting on the 26th April 2006 at INESCOP – Elda (Spain).

3.3. Contractors, changes and changes to Consortium.

There have been some changes concerning the partnership composition during the first reporting period. During the kick-off meeting, the partner ROMAGNOLI informed the Consortium about the change of their registered name. For this reason, INESCOP, as project coordinator, made a request to the European Commission for amendment to the contract.

During the amendment process, this company decided to withdraw from the project. The reason mentioned was that they were facing certain difficulties in meeting all the demands of their market and that they could not devote as much time as they would like to carry out the project activities, due to the lack of skilled people. They wished the project partners the best success for the completion of the project.

Therefore, INESCOP made a new request for amendment to the contract. Finally, in order to substitute the partner ROMAGNOLI, the following entity was added as Contractor with effect from 1st April 2004 as specified in the following table:

<p>CF SRL (SME) established in VIA DE GASPERI, 4, 05034 FERENTILLO (TR), Italy, represented by Mr. Bruno Constatino, General Manager, or her/his/their authorised representative ("<i>contractor</i>").</p>	<p>Start date of participation:</p> <p>1st April 2004</p>
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Article 1.2 of the contract was modified accordingly. For reallocation of the tasks of the proposed new contractor, a Consortium's proposal was made. The modified version of the Technical Annex I with a direct replacement of tasks was sent to the European Commission and it was approved. The last version of this document is available on the project website.

On the other hand, the partners responsibilities remain as defined in the Technical Annex I and no formal changes to the contract are foreseen.

Furthermore, during the mid term review assessment the Financial Department of the European Commission informed the co-ordinator that in accordance to Article 9.1 of the contract, the partner ENECOL should not have received any pre-financing but only settled payments based on approved technical reports and financial statements accompanied by audit certificates.

In order to be able to proceed with the approval of the reports, to facilitate the management of this project and to regularise the situation a request to amend (withdraw) the special clause under Article 9.1 was made.

Therefore, the special clause has been removed from Article 9 of the contract. All other provisions of the contract and its annexes remain unchanged.

Finally, during the latest year another letter was sent to the European Commission to inform that the authorised legal representative of the partner Universidad Politécnica de Valencia (UPV) had changed.

4. Other issues.

There are not any other issues.