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Consortium

Contact

AIMPLAS - Instituto Tecnológico del Plástico

C/ Gustave Eiffel, 4 (València Parc Tecnològic)

46980 - PATERNA (Valencia) - SPAIN

(+34) 96 136 60 40

phoenix@aimplas.es

www.phoenix-eu-project.eu

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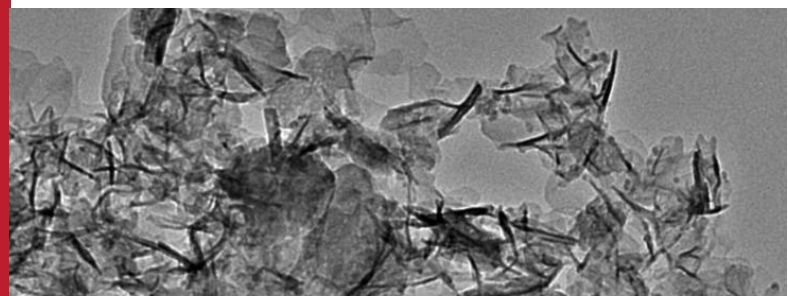
PHOENIX

Synergic combination of high performance flame retardant based on nano-layered hybrid particles as real alternative to halogen based flame retardant additives

Starting: January 2013 / Duration: 48 months



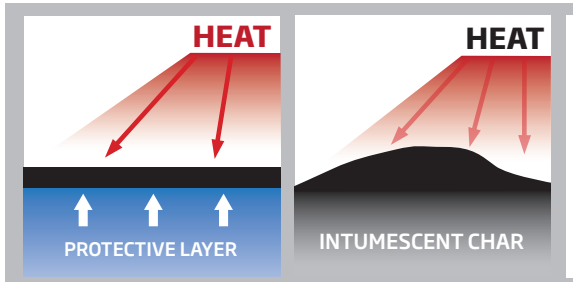
About PHOENIX

Electrical and electronic (EE) applications – including housings, wire and cable, and internals such as connectors– are the largest market for **flame retardants** (FR) in plastics globally. The need for flame retardancy is increasing due to electronics miniaturization and higher temperatures in both processing and use. PHOENIX project is an ambitious multidisciplinary innovative threefold approach to develop:

» **A new concept of FR nanostructured materials**, based on new non-halogenated flame-retardants applying nanotechnology to replace hazardous chemicals to produce sustainable FR additives based on nanolayered structures and modified lignins, produced with innovative and green chemical routes, for thermoplastic and thermoset applications.

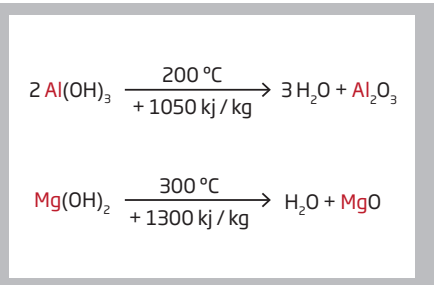
» **Simulation and modelling of compounding processes for the preparation of optimal nanocomposites**, avoiding aggregates and achieving the best dispersion of the nanoparticles in the polymer matrix.
The achievement of these results will represent a significant advantage to the participating SMEs and in turn to the **End-Users** demanding high-performance environmentally friendly FR materials to manufacture high-performance parts.

PHOENIX's flame retardant systems are based on the combination of three different synergic effects against fire in just one particle



Phosphate based FR: Formation of a protective vitreous barrier

Graphene & modified lignin FR: Intumescent Char & reduces the heat release rate



Nanometallic hydroxides: release water & absorb fire reaction energy

Self-assembly technology → Nanoplatellets structures

» **Innovative processing routes**, providing solutions to the demands of the EU Industry regarding FR, finding a true cost-effective and sustainable alternative to existing non-environmentally friendly HFR, which allows simultaneously a significant improvement of mechanical properties and processability, highly limited with the existing non-halogenated FR available in the market for compounding, extrusion and injection moulding processes. New compounding techniques such as Nanodirekt process, and high innovative systems, such as ultrasounds mixing systems coupled to extrusion and injection equipments, will assure high nanoparticles dispersion in the polymer nanocomposites and in the final pieces, thus achieving optimal properties.

Applications and markets

» Electrical / Electronic Devices (E&E)
» Low-voltage wires
» Household appliances

Objectives

01. Produce sustainable FR nanoparticles: water-based production methods
02. Self assembly technology will be used to functionalize nano-layered FR particles and produced ordered nanostructures.
03. Develop FR additives from renewable sources based on lignins modified by boron and phosphorous reagents to improve RF properties.
04. Reduction of FR content up to 15%w/w
05. Nanoparticles dispersion improvement during compounding applaying NanoDirekt process
06. Develop a new module for LUDOVIC compounding simulation software in order to optimize FR nanocomposites dispersion
07. New FR compounds with good processability employing conventional extrusion and injection moulding machines or assisted by ultrasound devices to improve nanoparticle dispersion
08. Competitive cost: less than 20% increase over halogen FR
09. Study co-extrusion and co-injection processes to decrease the FR content and achieve good mechanical properties. (functional layer + structural layer)
10. Develop stable epoxy pre-pregs containing FR nanoparticles
11. Increase in a 10% the mechanical and thermal properties of the new FR compounds compared to halogen FR materials
12. Fully recyclable compounds (up to 30% will be added to the virgin polymer decreasing mechanical properties less than 10%)
13. Develop a methodology for a quick in-line test to evaluate FR resistance
14. Positive environmental impact
15. Materials selection will take into account technical, performance, health, environmental and economic factors