

POLYMERS

NEW MATERIALS



THERMOSETTING COMPOSITES REINFORCED BY IONIZATION MODIFIED NATURAL FIBERS

E-BEAM

INTERMEDIATE AND HIGH ENERGIES

RADIATION-GRAFTING – ADHESION PROMOTER

THE BIONICOMP PROJECT

The **BIONICOMP** project aims to improve the overall performances of composites with bio-sourced reinforcements to compete and replace fiberglass composites for a significantly lower weight.

Adhesion between the fibers and the matrix is a major challenge for the use of polymer composites reinforced with natural fibers. The weight reduction induced by the use of such lightened composites is an economic and environmental issue for all modes of transport, as well as for other sectors such as leisure & sports and technical protective textiles.

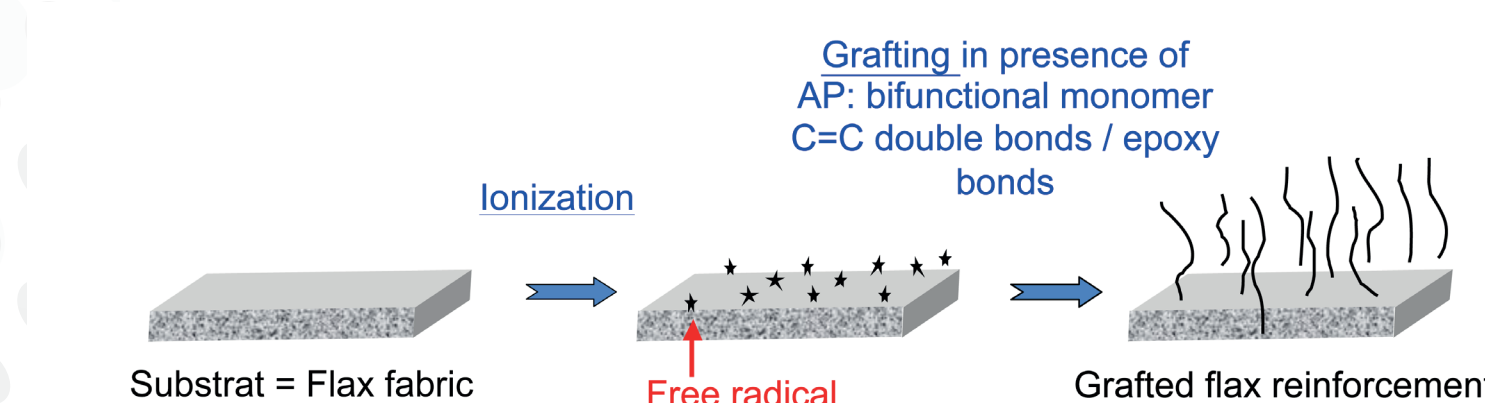
The innovations concern the reinforcement of the fiber / matrix adhesion in the case of flax fibers with thermosetting matrices (epoxy-amine type), by means of the radiation -induced (ionization) grafting of an adhesion promoter (AP) on the fibers, intended to multiply the covalent interactions between constituents.

EXPERIMENTAL DESIGN AND RESULTS

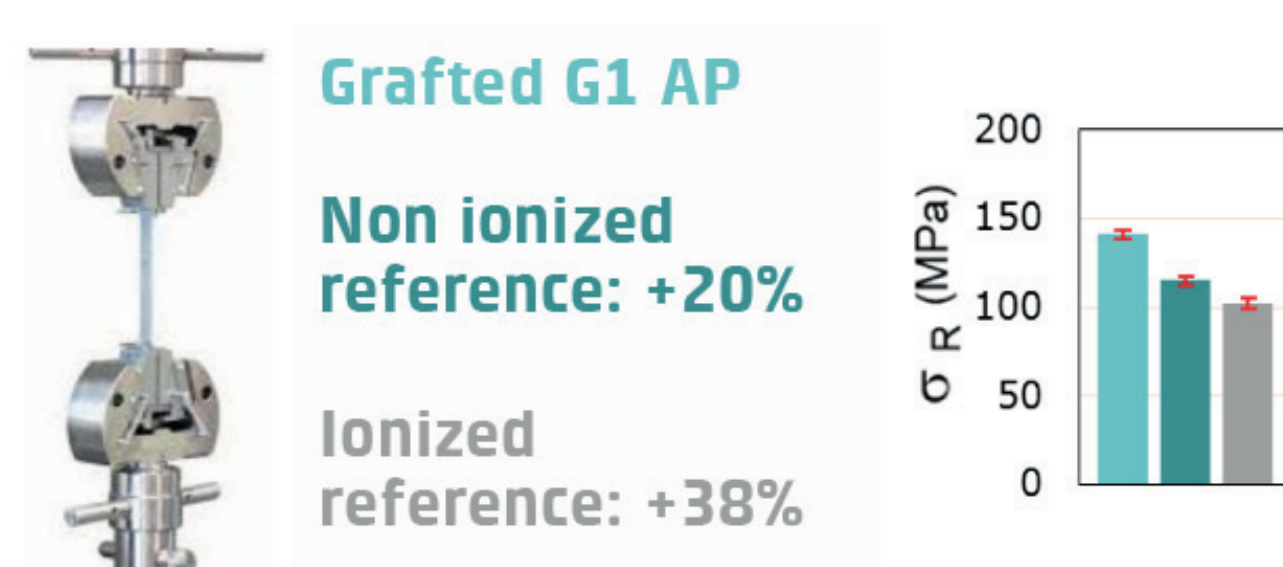
Ionizing rays treatment by accelerated electrons allows grafting of an adhesion promoter.

A 10 MeV, 28 kW LINAC accelerator at the Ionisos facility in Chaumesnil, France, is used as part of this project.

Ionization of organic molecules, as lignocellulose based-macromolecules, polymers, monomers or oligomers, creates spontaneously reactive species that induce free-radical based chemical reactions:



Mechanical tensile tests at 0° and 45° on epoxy composites made:

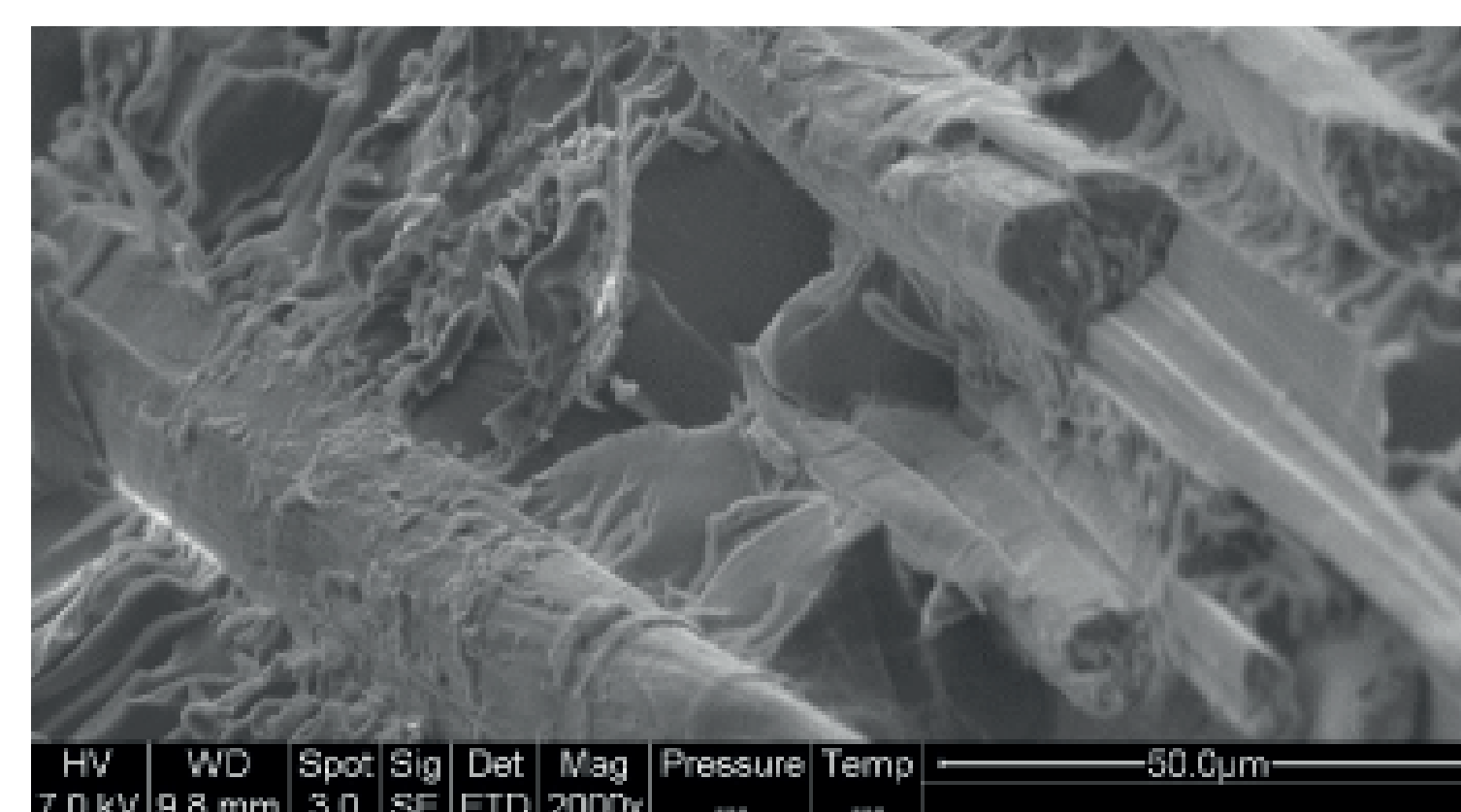


With a Scanning Electron Microscope (SEM), after a fracture, we observe a ductile deformation attesting a coupling (interphase) between the fibers and the matrix.

CONCLUSIONS

Proof of concept of a radiation-grafted adhesion promoter acting as a coupling agent.

Improvement of the mechanical properties (tensile apparent modulus at 0° and shear modulus) is noted after addition of AP (epoxy linseed oil) and radiation treatment. The effect is not enough to achieve the project's objective but confirmed by morphological observations (SEM).



Weakening of the reinforcement due to ionization.

Suspicion of a different sensitivity to the radiation of the weaving structure of the reinforcement.



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