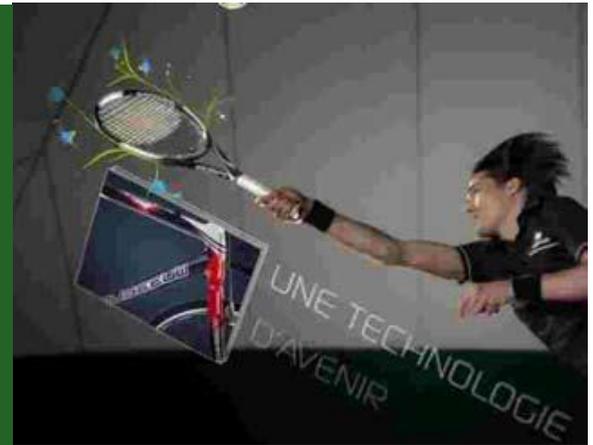


LINEO - FlaxPreg

FlaxPreg Breakthrough Eco-Friendly Technology Opens Up New Markets



Case History

With the help of FlaxPreg, a revolutionary method of combining the damping properties of flax with the well-known high performance of carbon fiber is being used to make a range of tennis rackets for players of every ability.

Bringing a new eco-friendly technology, LINEO, winner of the JEC 2010 Bio-Based Award, will help tennis players of all abilities.

Lineo's FlaxPreg products have facilitated a revolutionary method of incorporating renewable flax fibers into composite materials to make tennis rackets which will damp vibration and provide smoother play for every enthusiastic tennis player.

The ultimate technical goal was to combine the damping properties of flax with the well-known high performance of carbon fiber without sacrificing mechanical performance.

Using hybrid technology to combine flax fibers and carbon fibers, up to 25% of flax fibers have been used for different racket build-up during the screening evaluation phase, using a flax-based commercial prepreg made from a unique yarn treatment and impregnation process which overcomes past technology problems of working with flax.

The unique process incorporates flax into composites to give the racket an amazing ability to absorb the vibrations on ball strike, increasing performance and playing

comfort. After two years in development, tennis players of any level will soon be able to buy affordable rackets which absorb vibrations, helping them to play better tennis.

Lineo supplied pre-impregnated flax solutions on an industrial scale allowing renewable materials to be incorporated into composite products.



"Flax fibers can now be considered as a genuine reinforcement fiber, to be used alone or with conventional fibers such as carbon, glass, aramid or basalt, providing high damping properties to composite structures."

Philippe Christou, Huntsman European Technology Director

• Application:

- FlaxPreg used for the manufacture of a range of tennis rackets for players of all abilities
- Suitable for sports markets, leisure, furniture and transport

• Advantages for users:

- Damping properties without sacrificing performance
- Can be used alone, or with conventional fibers such as carbon, glass, aramid or basalt
- Flax containing reinforcements suitable for many different markets that can be sized fabrics for direct processes such as wet lay-up, infusion and RTM and which can also be flax prepregs

• Key features:

- Eco-friendly
- Affordable
- Enormous range of colors available

• Lineo Advanced Materials used:

- FlaxPreg UD 180





Case History

New technology to blend flax with epoxy resins in such a way that absorption of water from the flax is prevented and strong bonds between the flax fibers and the epoxy resin are created.

“Since the start of this project two years ago, we have done many, many trials to find the right blend and ratio between flax and carbon fibers so as to get the best performance from the racket. From the beginner to the expert tennis player, Artengo can supply something for everyone.”

“We found that low environmental impact is not the only advantage of flax fibers. Their intrinsic technical properties can also make significant contributions to improving the performance of the finished product.”

Francois Vanfleteren, Lineo CEO

“This is an application which illustrates the involvement of Huntsman’s ongoing participation in sustainable and eco-friendly technologies. By leveraging our core competencies, which include synthesis and formulation, testing and analysis, process manufacturing technology and technical service, we can develop sustainable products that benefit our customers, consumers and the planet as a whole.”

Philippe Christou, Huntsman European Technology Director



Lineo uses new technology to blend flax with epoxy resins in such a way that absorption of water from the flax is prevented and strong bonds between the flax fibers and the epoxy resin are created.

Key to achieving success is the sizing and blending of the flax fibers with the epoxy resin. This was achieved through the partnership between Lineo and Huntsman research laboratories, who together made a series of detailed measurements of the composite parts which enabled them to calculate the optimum blend for processing.

Lineo can also add colors to the blend through a method which has been specifically developed for the process based on textile coloring technology.

Francois Vanfleteren, Lineo CEO said: “We’re marketing the rackets through the leading French sports supplier, Artengo. They have been amazing! The team has taken the time to understand the features of the flax fibers and developed and trialed

prototypes for use in their rackets. It was a big challenge while other sport brands still focus on 100% carbon reinforcements.

Describing how they went about producing the racket, Francois said: “First, we started by supplying flax preregs to Artengo, who after testing a number of prototypes assessed the potential.

“We then moved on to the next stage of development with modifications being made to the fabrics and the impregnation process. In parallel, we worked on finding the right lay-up for the rackets.

“Then, with the help of the laboratory LRPMN from Alençon, Artengo had the right preregs and lay-up. Overall, our partner Decathlon/Artengo did a great job for tennis players of all abilities. “

Artengo, a leading French supplier of a range of racket equipment and part of the Decathlon S.A. group, is already marketing a tennis racket with 15% flax and very shortly will be marketing another racket with 25% flax.

“Initially working with flax preregs was quite challenging, but the hurdles have been overcome, and now it is possible for new products to contain more flax preregs”, said Francois.

Intrinsic flame resistance is another property which will be explored and will certainly make flax fibers attractive to other markets such as transport.

Major markets to benefit from the new eco-friendly technology are sports, leisure, furniture and transport, with cycling and tennis being the first sectors where the technology has been put into commercial production.

