

Nano-Engineered Composites

Industry Case Studies

Zyvex Technologies
October 2013



Aerospace



Automotive



Industrial



Marine



Sports

Aerospace Case Studies



Nacelle Lining + Arovex®

Zyvex partnered with one of the largest global aerospace manufacturers to help them deliver the next generation in commercial engines. They needed a lighter, tougher nacelle lining with increased toughness, zero weight gain, and no major price increases over standard solutions.

Our Solution

Zyvex developed a new 350°F curing carbon fiber variant of Arovex®, the class-leading prepreg enhanced with nanomaterials. Arovex® underwent a battery of tests over two years against the toughest composites in the world.

The Result

Arovex® withstood all challengers, coming out on top as the toughest, most effective composite available. Arovex® delivered: +42% toughness, 0% weight gain, and competitive pricing.

Industry Consortium: Nanotechnology Development for Airbus

Zyvex Technologies is part of a 5-year research and development consortium for Airbus led by the National Composites Center in Dayton, Ohio, USA.

Zyvex is providing technology related to the dispersion of carbon nanotubes intended to improve the mechanical properties of high performance composites.



"Airbus is proud and excited to be a partner with the NCC and Ohio as we work together to develop the composite technology for the next generation of aircraft," said Allan McArtor, Chairman-Airbus Americas. "Airbus' intent is to double its procurement spend in the U.S. over the next few years, and there's no reason Ohio companies can't benefit from that. The state has so much to offer, and we already have a growing and thriving partnership. I predict even more great things in the future."

Automotive Case Studies



Repairs Using Epovex® Adhesive

The automotive market is driven by an expectation of higher performance. Zyvex Technologies is committed to delivering leading products and services based on our exclusive molecular chemistry expertise. Our line of nano-enhanced products has demonstrated their place on the racetrack where the highest level of performance is non-negotiable.

Racing vehicles such as the Audi Racing and Genoa Racing ALMS cars use Zyvex Technologies' Epovex® Adhesive, the world's only carbon nanotube enhanced adhesive, to achieve this performance.

Our Solution

With the use of our advanced Kentera™ technology, Zyvex has been able to create a safe and superior bonding strength and hold-far stronger than welding or bolting. Kentera™ technology creates a bridge between carbon nanotubes and the epoxy adhesive, allowing for more efficient absorption of mechanical strain, resulting in an adhesive that is stronger, tougher and more durable than other glues.

By using Epovex® Adhesives, customers experience fewer secondary bond failures while saving money. With T-peel strength 30% stronger than industry standards and shear strength 20% stronger than industry standards, Epovex® Adhesive is delivering the strongest bond possible at the most economical price/performance ratio.

The Result

Audi Racing and Genoa Racing ALMS cars are already using this advanced adhesive. When a vehicle crashes, the team uses Epovex® to 'glue' their car parts back together quickly and on-site.

Genoa Racing, one of the most successful teams in Indy Lights and Atlantic history, was able to rapidly repair their ALMS car overnight because of Epovex® Adhesive's superior strength. In the morning, the car was ready to go, finishing the 2011 Baltimore Grand Prix session at the top of the LMPC class.

Arovex® Prepreg in the Automotive Industry

Zyvex Technologies recognizes the importance of greater fuel efficiency and believes that the most significant impact on automotive technology will come from better materials, not better engines. The world's leading automotive corporations have already embraced carbon fiber and the promise of lighter vehicles. Zyvex has automotive formulations of its proven Arovex® and Epovex® material available and encourages any interested industry partner to contact us for further information.



Industrial Case Studies



Prosthetic Socket + Custom Solution

Zyvex worked with Willow Wood, a leading prosthetic company, and the United States Department of Veteran's Affairs to develop a next generation resin system for better, more comfortable prosthetics.

Our Solution

Zyvex worked with our partners to generate a resin system specific to their applications, but made possible only with Zyvex's advanced molecular chemistry and nano-composite expertise.

The Result

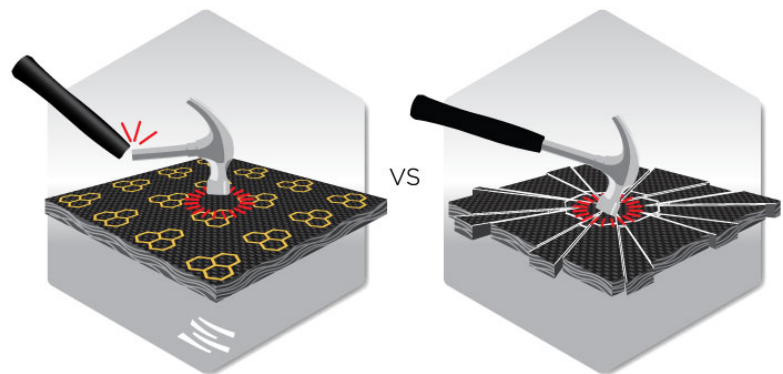
The next generation resin system increased comfort and reduced friction, enabling additional properties that are unavailable anywhere else on the market.

Cost Reductions: Lowering Weight and Improving Durability

Today's industrial and manufacturing facilities were built with materials developed decades ago. As industry continues to evaluate ways to reduce costs and improve efficiencies, nano-engineered materials powered by Zyvex offer advantages by reducing weight and improving durability.

Zyvex works with leading composite manufacturers to provide solutions ranging from a single part to full production runs. Our Arovex® formulations create a more durable composite that can withstand environments unsuitable for most other fragile composites.

arovex®



**Up to
3X Tougher**

**Standard
Composites**

Marine Case Studies



Marine Door + Arovex®

One of the largest North American hatch and door manufacturers partnered with Zyvex to deliver a next generation door to reduce weight, making for a much safer option for all sizes of vessels.

As vessels large or small move through the water, the weight of a swinging door can become a safety hazard. To mitigate potential injuries and liabilities to crew and passengers, lighter weight doors are preferable. The marine industry typically uses aluminum to meet this need, but our partner wanted to offer a solution lighter than anything on the market for the highest safety margin.

Our Solution

Zyvex used Arovex® to provide a lightweight and extremely durable solution.

The Result

Using Arovex®, product weight was reduced weight by 60% while maintaining full compatibility with existing parts and maintaining the same level of strength as the standard aluminum product.

Marine Vessels Created with Arovex®

The world's oceans can be harsh, unforgiving, and costly. Zyvex delivered multiple long-range carbon fiber patrol craft for use in anti-piracy and security. With ranges up to 1500 nautical miles, a 300% increase over comparably-sized craft, Zyvex delivered a cost-effective solution built entirely from Arovex®, our class-leading carbon fiber prepreg.

Zyvex has also provided unmanned surface vessels to the Republic of Singapore Navy. The reduced weight of Arovex® allowed for a larger hull at 17 meters, enabling greater payload and more sophisticated onboard electrics.



Sports Case Studies



Bike Wheel + Arovex®

ENVE Composites, creators of the world's toughest bikes for the world's toughest downhill races, turned to Zyvex and our Arovex® prepreg material to give their riders the winning edge.

Zyvex partnered with ENVE to develop tougher, champion-quality wheels for their downhill performance bike.

Our Solution

Arovex® was intended to reduce wheel fractures and improve overall durability.

The Result

The new Mountain DH rims, powered by Arovex®, reduced fractures per season from 75 to ZERO. Typically aluminum rims were changed 180 times per season, but the new Mountain DH rims were used without replacement for an entire season, and carried ENVE-sponsored rider Greg Minnaar to victory at the 2012 World Cup opener in South Africa. These rims and other ENVE products using Arovex are now available to the public in stores and at www.enve.com.

Lacrosse Shafts + Arovex®

C-12 Lacrosse recognized that lacrosse is one of the fastest growing sports in the United States. The Sporting Goods Manufacturers Association (SGMA) found that between 2001 and 2010, participation in lacrosse is up 218.1% with popularity among both men and women. Because of the sport's rapid growth and the little innovation in the market on shafts since the introduction of titanium in 1992, C-12 decided that they should enter the playing field with a new shaft that was lighter, stronger and overall better than titanium, which all the premier lacrosse companies were using.

C-12 was able to achieve incredible strength and toughness by incorporating the most advanced carbon fiber material, Arovex®, a carbon-nanotube enhanced prepreg made by Zyvex, into their shafts.

C-12's design allows for faster shots, and better passes, ball control and temperature resistance. Their seamless braided carbon fiber, the highest performing carbon available, eliminates all weak points from the shaft. This superior durability has led to a field failure rate of zero, breaking the perception that carbon fiber lacrosse sticks cannot withstand the physicality of the sport.



The exo-skeleton structure is designed to add a controlled flex, create unparalleled strength, and transfer energy axially for better control. The film used to wrap the shaft is extremely tough and allows C-12 to reverse print customer-specific graphics.

Increasing rapidly in popularity, C-12 moved to a larger manufacturing location before their first year was over. Carbon fiber had been used in lacrosse shafts before, but they had never incorporated the strength and durability that C-12 could achieve.

The performance of the shaft underwent the ultimate tests when a 6-foot-2, 215 pound man stood on the shaft and when the shaft was used to deadlift 270 pounds. In both cases, neither shaft became broken, dented, or bent.

Today, C-12 Lacrosse is working with Zyvex to incorporate the next innovative line of advanced composites into their shafts, including enhancements from carbon nanotubes and graphene. To play to the best of your ability, you have to have the best equipment, and C-12 provides just that.

Easton Sports - NanoSolve® Baseball Bats

Zyvex pioneered the first commercial use of carbon nanotubes with our partnership with Easton Sports starting in 2005. Zyvex provided a unique dispersion of CNT material designed to enhance the product portfolio of Easton as well as integrate easily into their manufacturing process.



Easton Sports announced the addition of Zyvex's NanoSolve® Materials to Easton's StealthCNT baseball bats. According to Easton, Zyvex's NanoSolve® Material "strengthens composite structures to provide improved handle designs with optimized flex, responsiveness, and more 'kick'."

Today, the R&D100-award winning technology in NanoSolve® is widely used across our advanced materials, and our additions of graphene and other carbon nanomaterials have enabled even higher levels of performance.

Contact Zyvex

For United States quotes, orders and product information call toll free 877.Go.Zyvex (877.469.9839).

For international quotes, orders and product information call +1.614.481.2208.

For Sales & Technical Services call +1.614.481.2207.

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