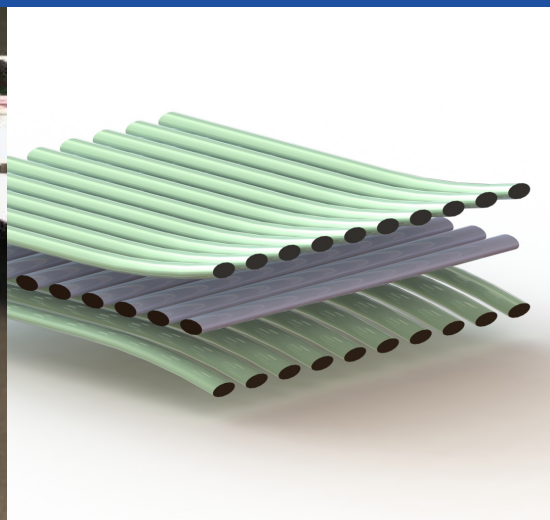
Challenge Accepted.

FASTER TO THE FINISH LINE WITH COMPOSITES IN RUNNING SHOES

AVIENT™

» **CASE STUDY:** POLYSTRAND™ THERMOPLASTIC COMPOSITES



FIBERGLASS REINFORCED COMPOSITES ENHANCE INSOLE PERFORMANCE AND COMFORT

THE CHALLENGE

Running is a passion for many people around the world. Whether they do it for recreation or competition, runners are continually looking for ways to improve their performance. The choice of shoe plays an important role in the experience, and the insole is a critical component contributing to the shoe's performance. With extensive experience in the composites industry, Gordon Brown, President and Founder of Flexi-StiX, LLC, recognized the value that composite materials could bring to an insole. Seeking to create a more innovative and comfortable insole using state-of-the-art materials, Gordon and his partner, Jeff Milliman of Greenville Running Company, went to work.

Creating comfortable insoles for runners proved to be more of a challenge than anticipated. More than 25 years ago, Gordon and Jeff tried to develop a commercially viable, molded composite outer sole for a running shoe using carbon fiber and fiberglass composites. The fiberglass material, which is less stiff than carbon, proved to provide greater comfort and gave the energy return they were looking for. According to Gordon, carbon fiber, despite its energy-returning effects, is not as friendly as fiberglass for a runner's muscles, tendons, and joints. Using the lessons learned from the outer sole development, Gordon and Jeff set out to find a fiberglass-reinforced material for the shoe insole application that embodied the energy-returning effects of carbon fiber while also demonstrating the flexibility needed to preserve and support the body and muscles of the runner.

THE SOLUTION

After extensive research, Gordon found the material that met his requirements: Avient's Polystrand™ unidirectional thermoplastic tape. Polystrand fiberglass-reinforced composite tape is not only lightweight and durable, it is moisture resistant. Working with Avient, Gordon and Jeff developed the patent-pending FlexSpring™ insole using a tri-ply unidirectional fiberglass laminate, combined with neoprene foam sheet material, and die-cut to shape. The neoprene layer provides comfort and space for the unidirectional laminate to deflect downward as the runner's foot strikes the running surface. Then, the composite laminate returns the stored energy, thus setting the runner up for an overall stride length increase and/or a faster running gait. The insole results in reduced overall fatigue—essentially springing the runner forward.

THE IMPACT

Using Polystrand composite materials, Flexi-StiX created a high-performing insole capable of returning energy for potentially faster running and improved overall run experience. The insoles add comfort to any running or walking shoe, with many users reporting that their recovery following a long run was significantly reduced.

FlexSpring can replace existing insoles in athletic shoes currently on the market, or they can be integrated into the athletic shoe manufacturing process as part of the midsole. Beyond running and walking, these insoles can be a game-changer for sports such as basketball, volleyball, tennis, etc. where repeated impacts from jumping and running are prevalent. The enhanced "springiness" of FlexSpring insoles also improves vertical jumping performance compared to non-composite reinforced insoles. Outside of sports, FlexSpring insoles will benefit workplace employees who are required to stand for hours, decreasing overall muscle fatigue for a less straining day.

"The unique positioning of the continuous glass fibers within the Polystrand™ material makes the very thin profile of the FlexSpring™ composite insoles possible," said Gordon. "They fit comfortably in most athletic shoes, including racing spikes, with the glass fiber properties providing comfort and performance benefits to the user. This enhances their running and walking experience as well as increases the life of their athletic shoes. This technology is a game-changer!"

To learn more about how Polystrand continuous fiber reinforced composites can benefit your product, **call +1.844.4AVIENT** or visit **www.avient.com/composites**

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