



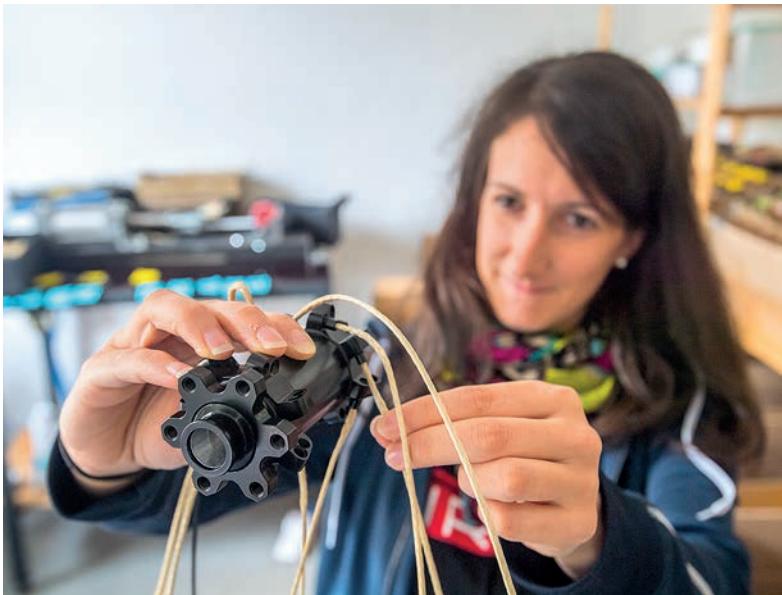


THE SECRET OF GEOMETRY

Textile spokes for mountain bikes



Ingo Berbig has turned his passion into his profession. A high degree of craftsmanship is required. Everything revolves around the wheel.



How do you make ultralight bicycle spokes out of textile?

“With know-how, that’s how”, says Ingo Berbig. After majoring in drive technology and textile engineering – two traditional core sectors of Saxony’s economy – at Chemnitz Technical University, he went on to specialize in technical textiles. Berbig has been a researcher in the industry since 2006, and established his small wheel and spoke business, called PI ROPE, in an abandoned textile factory on the outskirts of Chemnitz in 2017.

Sports equipment of this kind has to meet high standards. As an athlete and engineer, Berbig says that he always sees his product from both sides: “What does a mountain biker expect from his bike in terms of impact resistance? What can we do with this material, both technologically and commercially?” The secret of the fibre spokes lies in the geometry – as the company name PI ROPE indicates. But not only the spokes have to work. Cyclists want a fully functioning overall product with all components performing in harmony.

The fibre is braided in-house by PI ROPE, then prefabricated by hand to create the spoke. After that, it is integrated in the hub and rim to make the wheel. The long-term goal is to establish PI ROPE as a brand with a strong commitment to quality: “We don’t want to be a mass producer”, the company’s founder says, explaining his philosophy. “Our intention is not to replace steel spokes by producing large batches, but to hone the concept of craftsmanship and make premium products.”

AN INTELLIGENT WEB OF INNOVATIONS

It may not seem so at first glance, but a great deal of innovation has gone into the fibre spokes. The geometry, function and impact resistance of a wheel with textile spokes differ from carbon or aluminium-and-steel wheels. Ingo Berbig explains the advantages: “Our spokes withstand extreme stress in terms of both the magnitude and duration of the forces, thanks to the absorption properties of the technical fabric.” The braided textile absorbs disruptive vibrations from the ground better than steel or carbon. Berbig knows from his testing that despite their flexibility, energy is not lost. All the force initiated by the rider on the wheel is transmitted to the ground. The light weight of the spokes is also hard to beat: Compared to the lightest steel spoke on the market, which weighs nearly 4.6 grams, the textile spoke made by PI ROPE tips the scales at just 2.2 grams. “The sophisticated design of the textile braiding exhibits high tolerance to tensile fatigue stress”, the researcher explains. “That is also true for the extreme alternate loading, meaning full compression loading on one side of the wheel and unloading on the opposite side.”

The product’s success is not thanks to the work of just one man. The other members of the team are engineer Stephanie Rötlingshöfer and David Weghaupt. David trained as a bicycle mechanic, is currently studying for a degree and doing a student placement at PI ROPE. Mounting the spokes requires teamwork.



Textile spokes of various thicknesses and lengths are ready to be assembled.

"Twenty-eight textile spokes are screwed into the hub and then assembled to the rim", says Stephanie Rötlingshöfer, explaining the process. Once everything is connected, the wheel is placed in the truing stand and adjusted both vertically and horizontally to within a tenth of a millimetre. In addition to impact resistance and service life, this high precision in ensuring the concentricity of the wheel is a third quality feature of PI ROPE's products. "The more homogeneous the geometry of forces between the hub, spoke and rim, the better the wheel will perform as a whole", says David Weghaupt.

A PRODUCT THAT EXCEEDS STANDARDS

Before the wheels with textile spokes were launched on the market, they were put through numerous tests. The bicycle industry sets standards for testing wheels. The PI ROPE team subjects its wheels to its own tests, which go far beyond these industry standards. Set up in the cellar, Ingo Berbig has a testing device he developed with colleagues at Chemnitz Technical University. Loaded with a 100 kg weight simulating the cyclist, the wheel runs





on a drum with four obstacles. It is driven through 2.2 million test cycles at a speed of 25 km/h, considerably more than the industry standard of a 67 kg weight and 700,000 cycles.

"We found that whenever we take a wheel to its endurance limit, it is always the rim that breaks first, not our spokes", Ingo Berbig tells us. "That's ok if it happens at peak load, but we have to determine the limit ranges." Knowing the limits is especially important when the wheels are used by professional cyclists, such as Jens Roth, German champion in cross triathlon, or Blaža Pintarič, World Cup winner from Slovenia. The German Technology Racing Team, Germany's most successful national junior team, is also fitted out by PI ROPE, as are the Bavarian CIS team and Lukas Ittenbach. These riders give the company valuable feedback on its products.

PI ROPE has already patented its textile spoke. The small business quickly gained international recognition and now delivers its products Europe-wide to Alpine countries such as Germany, France, Italy, Austria and Switzerland, bicycle-crazy Belgium, and Scandinavia in the far north, as well as all over

the world to Australia and Brazil. The number of PI ROPE fans at home in the Ore Mountains is growing too. The region has developed into a hub of mountain biking in recent years, and PI ROPE's technical expertise and craftsmanship are in high demand.

The team understands its target group and has excellent contacts in the scene. All three team members are keen, ambitious mountain bikers. In June 2019, Ingo Berbig took part in Chemnitz's Heavy24 race, a prestigious 24-hour mountain bike race over 400 kilometres, and came in tenth. He tells us about it as we stand in the workshop, where the test bicycles are assembled. A machine hums in the background, where the textile threads are being precisely braided. This is where Ingo Berbig keeps his personal fleet, including a historic bicycle he is restoring for Chemnitz's Museum of Industry, various mountain bikes and a racing bike. The team is already working on the next innovation: They are planning to extend their expertise to road racing and are currently in the test phase.