

## Cross-Country Skiing Made Easy

Cross-country skiing goes back a long way, yet is attracting new followers. The high-tech systems by Madshus and Evonik are making believers of beginners.



*Many winter sports enthusiasts have rediscovered cross-country skiing, thereby fueling a new trend in winter sports. Cross-country skiing has become increasingly popular over the years, not least inspired by the successes of top athletes from Germany. For both professional and amateur skiers, equipment in particular is the next important priority after stamina. It determines who gets to step up on the winners' podium and makes ski vacations enjoyable and safe. For several years, Madshus, a Norwegian ski manufacturer, has been using a high-performance rigid foam made from polymethacrylimide (PMI) as an integral part of its ski core.*

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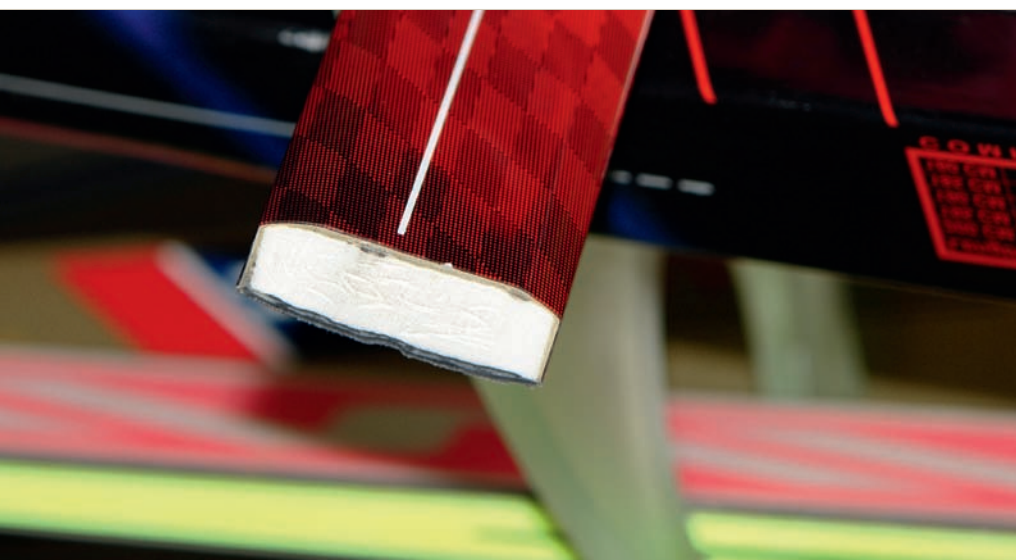
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Exciting competitions and broad media attention have made biathlon and cross-country skiing increasingly popular. Like no other, this age-old sport is enjoying a revival. Forget the slopes! Inspired by the athletes, more and more winter sports enthusiasts are discovering the ski runs, which present a real alternative to the ski resorts of the Alpine realms. In Scandinavia, for example, fun and an unforgettable outdoor experience go hand in hand, which offers the plus of healthy endurance training. Gliding through the snow is also good for one's health, since several muscles are activated, although without putting too much strain on the body. While technical prowess, physical strength, stamina and agility are what's called for in any athlete—pro or recreational—the quality of the skis does, of course, also play a vital role. There is one thing that both top-notch and recreational skiers have in common: They can count on the skis built by the Norwegian manufacturer Madshus.



Solid, rigid, and extraordinarily light, ROHACELL® is an ideal material for lightweight, yet durable skis. Made with a sandwich composite, the skis feature optimal flexibility and dynamics at low weight. Evonik's product is used as a material in box construction—an interior foam core surrounded by a layer of fiber-glass-reinforced plastic.

Madshus can look back to a long history and vast experience in manufacturing skis. It built its first skis in a barn in Vardal, Norway, in 1906. This makes Madshus one of the oldest ski manufacturers in the world, and one of the most successful, too. Recreational skiers were not the only ones who were soon waxing enthusiastic over the Norwegian manufacturer's quality. A growing number of professional athletes were also crossing the finish line on Madshus skis—at thus, at the "core"—on a product by Evonik.

Evonik. Power to create.



ROHACELL® combines dynamic properties with good formability. Madshus has used Evonik's material to develop top-quality racing skis. The Norwegian company has thus achieved a decisive weight reduction compared to skis with other foam core materials.

According to Madshus' development manager, Gunnar Bjertnaes, Evonik's ROHACELL® high-performance rigid foam has outstanding dynamic properties. Its malleability also means it has excellent processing properties.

"This sandwich core material made in Darmstadt has additionally allowed us to reduce the weight of the skis—which is a crucial factor," Bjertnaes explains. For each gram of extra weight, the athlete has to expend added energy.

Evonik's high-tech material is extremely strong and rigid—a fact attributable, not least, to the even distribution of small air bubbles in the foam structure. The highly rigid PMI foam can be durably combined with all conventional plastics by means of bonding or



pressing to create composites capable of taking extreme punishment. This makes it an ideal material for skis that are light as well as robust. The sandwich composite with which the skis are made improves their flexibility and dynamics while keeping their weight to a minimum. The foam's high heat-distortion durability and excellent creep-compression resistance also allow considerably reduced production times, which is important to ski manufacturers.

But how, exactly, is ROHACELL® used in Madshus skis? "We use this material in a box structure with an internal foam core sheathed by fiberglass-reinforced plastic," says Bjertnaes. Madshus has used Evonik's material in this way to develop top-quality racing skis under the Nanosonic model name. The Norwegian company has thus achieved a decisive weight reduction compared to skis with other foam core materials.

And this is how the skis are made. The foam panels are cut to size and coated with the fiberglass-reinforced material. In the last stage of production, the so-called bended camber is created, which has a major effect on the slide characteristics of the skis on the track. Precise technical specifications concerning attributes such as exact rigidity, pre-stressing, and pressure distribution are determined in a large number of tests with professional athletes. Thanks to this high-end material, these specifications can then be precisely implemented in production. "PMI foam is easier to form; the cores are more easily shaped to the required dimensions than honeycomb sandwich core materials," adds Bjertnaes, pointing out yet another advantage.

Madshus made the first sandwich-structure skis in 1976. The ski manufacturer and Evonik began working together in 1994, thereby opening up the way for the use of ROHACELL®. Bjertnaes cannot conceive the collaboration coming to an end: "We're already working on new applications. Since the start of our partnership with Evonik we've achieved a large number of improvements. And that's the way we intend to go on."