

## Skis for Champions

Top-competitive athletes rely on high-tech skis from Madshus and Evonik at the Biathlon World Championships in South Korea.



*Star biathletes taking top honors in a race do not owe their success to chance; it is the result of submitting to rigorous and disciplined training, daily physical and mental condition, and choosing the ultimate in equipment. Particularly important are the skis on which the athletes move quickly and surely from one shooting range to the next; among other requirements, the skis must be able to withstand high dynamic stresses of this top-competitive sport. This is why Norwegian cross-country ski manufacturer Madshus has for some years been using Evonik's ROHACELL®, a high-performance rigid foam made from polymethacrylimide (PMI), as an integral component of the ski core.*

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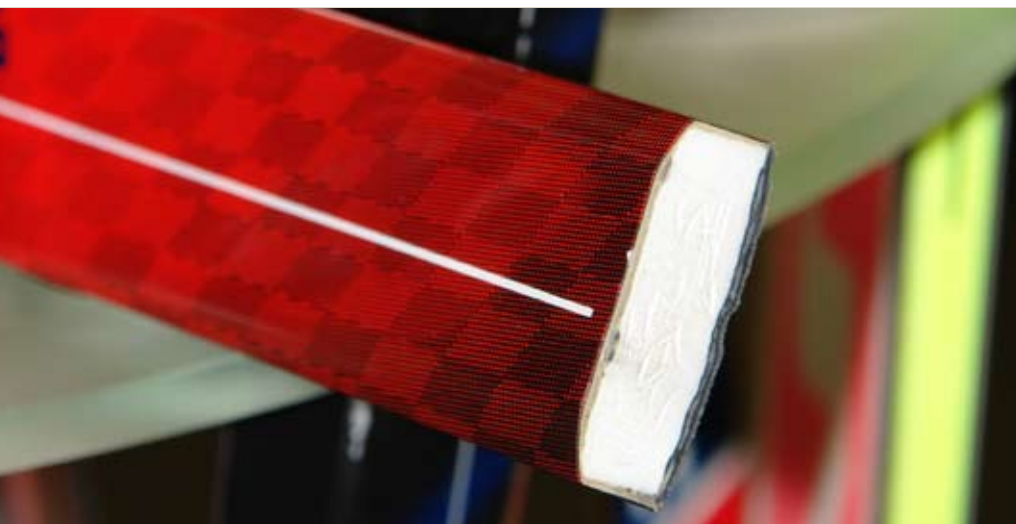
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The crème de la crème of biathletes are now gathered in Pyeongchang, South Korea, where the new world champions of the slopes and shooting ranges will be crowned till February 22. The Olympic champions Kati Wilhelm and Michael Greis have stepped up on the winners' podium, as has Norway's biathlon icon Ole Einar Björndalen. All three rely on high-performance skis from the Norwegian manufacturer Madshus—and so, essentially, on a product by Evonik.

World and Olympic champion Kati Wilhelm regularly goes to a sports facility in Sweden to test new ski models in the ski tunnel, because when it comes to competing, it is not just about fitness and physical strength. The quality of the skis makes a difference, too. "Because they play a very important role in competition, you also have to invest a lot of time in selecting and testing things so that you get perfectly designed skis that are suited to the conditions. Indeed, you've got to rise to the challenge successfully with your skis," emphasizes Kati Wilhelm with a wink of the eye.



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 the box construction—an interior foam core surrounded by a layer of carbon fiber-reinforced plastic.

According to Madshus' development manager, Gunnar Bjertnaes, ROHACELL®, a high-performance rigid foam from Evonik's Performance Polymers Business Unit, is distinguished by its outstanding dynamic properties; in addition, its ease of shaping makes for excellent processing.

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“And this sandwich core material from Darmstadt allows a dramatic reduction in the weight of the skis,” says Bjertnaes. For each gram of weight, an athlete has to expend more energy.



Winning gold with ROHACELL®: For top-notch biathlete Kati Wilhelm, the quality of the skis is just as important as fitness and physical strength. “Skis are very important for competition. By that I mean you have to invest a lot of time to get perfectly designed skis that are suited to the conditions.” The investment has paid off—with gold and silver at the 2009 World Championship in South Korea.

Evonik’s high-tech material is extremely strong and rigid, properties attributable 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 give 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 temperature and excellent creep compression resistance also allow considerably reduced production times, which is important to ski manufacturers

Where exactly is ROHACELL® used in Madshus skis? “We use this material in a box structure with an internal foam core sheathed by a carbon and fiberglass reinforced plastics,” 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 dramatic weight reduction in relation 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 fiber-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. Technical specifications such as exact rigidity, prestressing, and pressure distribution are determined in a large number of tests with professional athletes and can, thanks to this high-end material, be implemented precisely. "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. In 1994, the ski manufacturer and Evonik began working together, thereby opening up the way for the use of ROHACELL®. Bjertnaes cannot envisage the possibility of the collaboration coming to an end: "We're already working on new applications. Since the start of our partnership with Evonik we've made a large number of improvements. And that's the way we intend to go on."