

Innovative material mix for solar modules with insulating effect

The sun catchers

The solar industry is booming worldwide, and Europe is at the forefront of development. Until recently, a complex process was required to mount solar modules on rooftops to generate electricity or capture heat from the sun. Plastics experts from Bayer MaterialScience and their partners have now developed innovative solutions that exploit solar radiation while serving directly as roofing. These innovative sun catchers are significantly lighter in weight than a standard roof tile and even possess outstanding insulating properties for buildings.

The world needs energy, and renewable sources are increasingly expected to deliver electric power and heat in the future. In addition to wind power, the solar industry in particular is experiencing a boom and posting staggering growth rates: the European Photovoltaic Industry Association (EPIA) estimates that photovoltaic panels will account for about 9 percent of the global energy demand by 2030. By the end of 2010 alone, solar systems with a capacity of 40,000 megawatts had been installed worldwide for generating electric power. Germany, Spain, Italy and the Czech Republic have been the leaders in Europe in terms of advancing the use of solar power, although Belgium and France are close behind. Experts from Bayer MaterialScience are helping

along the way: together with medium-sized business partners, they have now engineered two innovative types of rooftop solar modules to market maturity: a photovoltaic module for producing electricity and a solar air collector that captures the sun's heat.

The great advantage: "The two modules don't just use solar energy; they simultaneously serve as roofing and, in the case of the air collector, even intelligently increase insulating performance. What's more, they are easy to install," says Jens Geschke, who manages the innovative Solar segment at Bayer MaterialScience.

Innovations in plastic promote the use of solar energy

In both cases, the material experts contributed their extensive expertise in plastics to help engineer these products. Take the frame of the SOLitaire photovoltaic module from the Solon company, for instance. Elements of this kind usually comprise individual glass plates fitted with solar collectors – called "glass laminates" – which are bolted into an aluminum frame to form modules. These are mounted by an electrician on a metal framework on a finished rooftop. The disadvantage is that it takes considerable time and effort to

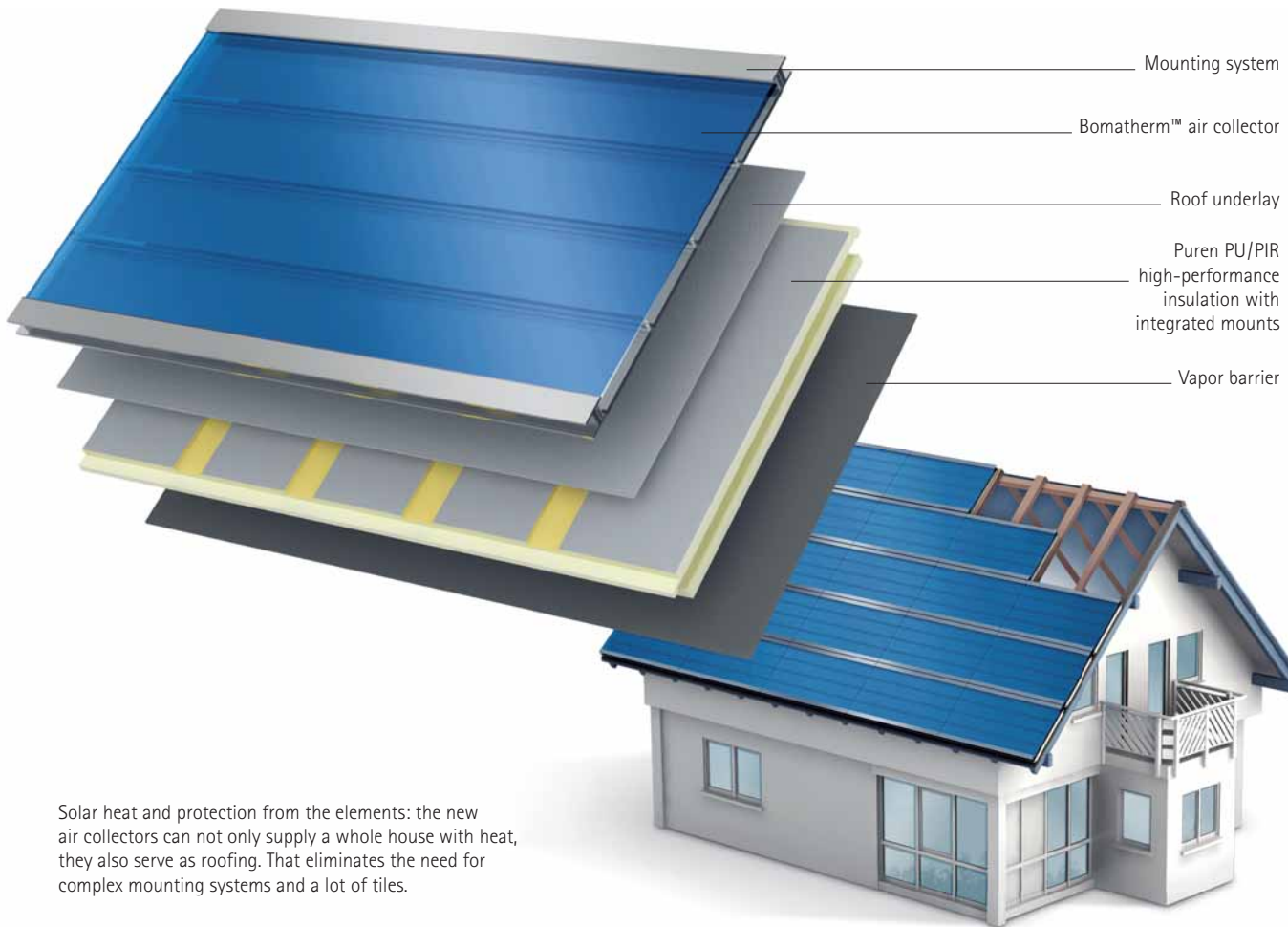
install such systems, "especially since the roofers must first tile the entire roof and then install the mounts for the panels," Geschke explains.

With the new SOLitaire module, all of that can be completed in one go, because the sun catcher itself functions as roofing. At the factory, the laminates are first placed in a mold and embedded in a Bayer polyurethane (PU), which cures in seconds to form a rigid frame. These flat PU modules are then bolted directly to the roof battens. The elements are shaped such that rain runs off them. In other words, they do two things at once: protect against precipitation and generate power. "In addition, a smooth and uniform roof simply looks better than the standard photovoltaic systems on metal frames," Geschke points out. This example of an in-roof solution illustrates, "that you can be highly innovative in this emerging market with new materials," the solar power expert says.

The demands imposed on the polyurethane are very high. The material must not become brittle at a chilly minus 40 degrees Celsius or when exposed to UV light. Furthermore, it must be long-lived, waterproof and withstand even severe hail storms. Fire protection is yet another crucial aspect the experts at Bayer



Materials specialist: Dr. Reinhard Albers of Bayer MaterialScience still sees a lot of potential in innovative materials for advancing the efficient use of solar energy.



Solar heat and protection from the elements: the new air collectors can not only supply a whole house with heat, they also serve as roofing. That eliminates the need for complex mounting systems and a lot of tiles.

MaterialScience had to consider in developing their polyurethane: the modules are installed right on top of a wooden roof truss, and are therefore made of highly flame-resistant polyurethane.

The Bomatherm™ solar air collector from Puren likewise required special plastics know-how. In this module, harnessing solar energy is combined with efficient thermal insulation. It can be integrated either as an in-roof or on-roof solution. "This way, home owners can insulate their roof and generate heat to support their heating or hot water systems," explains Günther Winnerl, Head of European Polycarbonate Sheet Marketing in the Semi Finished Products segment of Bayer MaterialScience. The module is comprised from top to bottom of a plastic vapor barrier, followed by high-performance PU/PIR insulation with integrated mounts. It prevents heat from escaping from the house.

On top of this is the actual heat collector: a newly engineered multi-wall sheet structure based on a special, highly heat-resistant polycarbonate, in which the air is heated. Like any other polycarbonate, this one would yellow when exposed to UV radiation. "To prevent that, a UV protection layer is added to the material directly during manufacturing," Winnerl says. As a result, the Bomatherm™ modules have a long service life.

Solar thermal energy systems normally operate on special liquids that absorb heat and transfer it via heat exchangers to the heating system. But the Bomatherm™ works without any liquids at all, because the in-flowing air, drawn from inside the building by a circulating air system, is warmed in the hollow structure by the sun's rays. The warm air is conducted into the house by fans, either directly into the ventilation system or through pipes into the heating system.

The new solar air collector design provides for multifunctional roof elements that are attractive, inconspicuous and waterproof. They weigh only half as much as a conventional tiled roof and provide efficient thermal insulation. The lightweight polyurethane rigid foam keeps out heat and cold so well that no additional insulation is required for the roof. And that applies for both private residences and commercial buildings. "Innovative materials are a key factor in moving the energy economy towards renewable sources, as all the examples plainly illustrate," summarizes Jens Geschke.

 www.research.bayer.com/solar
For more information on solar energy