Sustainable Wood Panels: A Modern Twist on an Ancient Craft

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Courtesy of SynEvol
Credit: Swiss Federal Laboratories for Materials Science Technology

Wooden shingles define the look of roofs and facades in the Alpine area and have been handmade for many generations. This age-old craft motivated researchers at Empa and ETH Zurich to utilize this highly effective wood separation technique for creating innovative wood-based materials. The article appears in the journal RILEM Technical Letters.

"Considering the increasing influence of climate change on our woodlands and the building industry, creating panels from split sticks is a clear option." "This indicates that they can be made from wood of different qualities and from hardwood varieties, resulting in reduced material waste and should nearly match solid wood products regarding strength," states Ingo Burgert, a Professor at ETH Zurich and head of a research team at Empa.

In Central Europe, spruce trees are facing growing stress from prolonged droughts. Consequently, more drought-resistant deciduous tree species will have a greater significance in the future. Simultaneously, most hardwood in this nation is presently incinerated for energy production—even though an increasing number of structures are constructed using wood, primarily because it serves as a renewable resource that retains CO2 within the building material for extended durations.

Traditionally, shingles are manually split from log sections, whereas industrial methods use pneumatic splitting equipment. "Burgert explains that shingle production demonstrates how wood can be processed efficiently in terms of energy and materials." "Timber can be divided along the fibers with little energy and nearly no waste." This chipless wood processing greatly enhances the yield of sawn timber, which, at approximately 60%, is notably lower in Swiss sawmills.

In conventional shingle manufacturing, only premium softwood of high quality is typically employed. To adjust the procedure for lesser-quality hardwood types and to divide longer pieces, the researchers utilize a two-step splitting method. Initially, flat components are divided, and they are subsequently transformed into wooden sticks of the required sizes.

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At a laboratory level, the researchers modified a device for the purpose of splitting firewood. Due to a multi-bladed splitting head, multiple boards or sticks can be created simultaneously in a single splitting operation.

The splitting method generates wooden pieces along the grain without severing the robust and stiff fibers. Nonetheless, the uneven form of the sticks presents a difficulty. To address this, Burgert and his team are depending on artificial intelligence (AI). A camera system that operates automatically takes high-resolution photographs of every wooden bar, which are then input into a neural network.

"Using AI, we can assess crucial wood characteristics like stiffness for every piece, regardless of its shape, size, or wood type," says Empa researcher Mark Schubert. In the future, if we utilize various types of wood with differing qualities, wood sorting will be essential. Utilizing our machine learning algorithms, we create as much information as possible regarding each specific piece of wood to optimally utilize it for wood-based materials with specified characteristics.

The team has pressed the initial panels without organizing the wooden sticks prior. Nonetheless, the possibilities of the created demonstrators are already clear: The panels can be fabricated in an extremely resource-efficient way and possess mechanical characteristics that render them perfect for load-bearing elements in the future.

In spite of difficulties related to production methods, adhesion, scalability, and the reliability of material characteristics, Burgert remains hopeful: "Our method could provide a sustainable option for utilizing wood amid the rapid onset of climate change."