



NEWS RELEASE

Singapore, 18 August 2022

NTU Singapore invents an invisible coating that turns wood “fireproof”

An invisible coating that can “fireproof” wood has been invented by scientists at **Nanyang Technological University, Singapore (NTU Singapore)**.

With the popularity of mass engineered timber growing in the construction industry, one of the biggest challenges for wood is its flammability. When untreated, wood or timber can burn and combust easily.

For instance, in the Great Fire of London of 1666, a large part of central London was burnt down as timber constituted a major part in construction of buildings. Today, most buildings are built using a combination of steel, concrete and glass, all of which are relatively less susceptible to fire.

Over the last decade, mass engineered timber is gaining popularity due to lower costs and faster construction, which sees productivity gains of up to 35 per cent. If the wood is harvested from sustainably managed forests, it also has a lower carbon footprint when compared to steel or concrete buildings.

Current practices to protect the interior of wooden buildings from fires require the use of fire-retardant panels (typically, gypsum and magnesia boards) or the timber has to be coated with paint-like fire-retardant coatings, both of which conceals the natural wood grain of timber.

In comparison, the new invisible coating developed by NTU allows for natural beauty of timber to shine and yet can still provide a flame barrier when “activated” by fire.

Invented by a team led by **Associate Professor Aravind Dasari** from the **NTU School of Materials Science and Engineering**, this fireproof coating is just 0.075 millimetres thick and is highly transparent, making it invisible to the naked eye.

When heated up by a hot flame, a series of complex chemical reactions happens, causing the coating to become a char that expands to more than 30 times its original

thickness. This char prevents the fire from combusting the wood underneath, as shown in an accredited lab test.¹

“Most timber or wooden panels only have a transparent coat that protects them from moisture, weather corrosion, termites or pests, and are not designed to withstand high heat. Thus, timber can still burn very quickly, especially if it is unprotected,” explained Assoc Prof Dasari, an expert in fire-retardant materials.

“In our coating, we used technology to lock certain compounds and interact with the resin. They will actively participate in the chemical reactions in a systematic manner when exposed to high heat, thus leading to the formation of char. This char was engineered to be extremely heat-resistant, insulating the wood underneath from the high heat.”

The innovation has a technology disclosure filed through **NTUitive**, NTU’s innovation and enterprise company, and the commercialisation project was funded S\$250,000 through the NTUitive Gap Fund.

NTU Vice President (Innovation and Entrepreneurship) Professor Louis Phee, described this innovation as a revolutionary step forward for the timber construction industry.

“Leveraging on NTU’s strengths in materials sciences and engineering, this is an example of how fundamental research can be translated into commercial applications with high impact, given that the invisible coating enhances both safety and aesthetics in timber construction with few to no drawbacks,” Prof Phee said.

“Innovations like this are what NTU can offer to industry players who are keen to work with us to license, commercialise and adapt technologies that can be used to create unique products that will ensure competitiveness for Singapore in the global market.”

The NTU team is now in licensing talks with different companies. **Venturer Timberwork** is actively exploring the usage of this innovative coating to protect their mass engineered timber elements in one of their current projects.

Bolstering engineered timber’s resistance to fire is critical to expanding the uptake of this technology across more of the built environment, says **Mr Kevin Hill, Venturer’s Managing Director**.

“At Venturer, like other stakeholders in the Mass timber construction sector, we believe more new projects will look at using this new coating technology if fire resistance can

¹ [Code of Practice for Fire Precautions in Buildings 2018](#) (Singapore Civil Defence Force), fire classification procedure for all construction products: [EN 13501-1](#) / EN 13823)

be improved. It has the potential to reduce cost and reliance on other more expensive solutions, such as using thicker timber to increase charring layers, or by encapsulating the timber with fireboards, which negates the beauty of this sustainable and productive building technology.”

This new coating is expected to be in high demand by the construction industry, as timber buildings need to meet specific fire codes for buildings set by regulators.

There are only a few products which can provide both transparency and fire retardance that are available in the market. Products which claim to have both properties currently are either extremely prohibitive in cost or are unable to pass international standards required for industry use.

In industry standard tests, such as the Single Burning Item² tests conducted at a third-party accreditation laboratory, the made-in-NTU coating achieved the highest class possible. When exposed to a high temperature flame, the coating generated very little smoke and is able to prevent the flames from spreading.

When the char is scraped off, the wood underneath is still intact, proving the efficiency of the coating to protect the wood.

This is important as in a case of a fire, construction materials need to be fire retardant and relatively smoke-free to allow for the safe evacuation of occupants in a building.

The global fire-resistant coating industry is also expected to grow to US\$1.06 billion market by 2029³, in a recent report by Exactitude Consultancy.

Moving forward, Assoc Prof Aravind will look to work with industry partners to test the effectiveness and longevity of the coating.

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² Industry standard test, as performed in line with EN 13501-1 / EN 13823, which are required by authorities such as the Singapore Civil Defence Force

³ *Fire-resistant coatings market by type (intumescent coatings, cementitious coatings), technology (solvent-borne, water-borne), substrates (metal, wood), application technique (Spray, Brush & Roller) and region, global trends and forecast from 2022 to 2029. Exactitude Consultancy. (2022, May 25).*
<https://exactitudeconsultancy.com/reports/2777/fire-resistant-coatings-market/>

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About Nanyang Technological University, Singapore

A research-intensive public university, Nanyang Technological University, Singapore (NTU Singapore) has 33,000 undergraduate and postgraduate students in the Engineering, Business, Science, Medicine, Humanities, Arts, & Social Sciences, and Graduate colleges.

NTU is also home to world-renowned autonomous institutes – the National Institute of Education, S Rajaratnam School of International Studies, Earth Observatory of Singapore, and Singapore Centre for Environmental Life Sciences Engineering – and various leading research centres such as the Nanyang Environment & Water Research Institute (NEWRI) and Energy Research Institute @ NTU (ERI@N).

Under the NTU Smart Campus vision, the University harnesses the power of digital technology and tech-enabled solutions to support better learning and living experiences, the discovery of new knowledge, and the sustainability of resources.

Ranked amongst the world's top universities, the University's main campus is also frequently listed among the world's most beautiful. Known for its sustainability, over 95% of its building projects are certified Green Mark Platinum. Apart from its main campus, NTU also has a medical campus in Novena, Singapore's healthcare district.

For more information, visit www.ntu.edu.sg

About Venturer Timberwork

Venturer, a Singapore company established in 1995, is a regional pioneer of the adoption of timber technology in the construction industry, including the first company to be listed under SCDF's product listing scheme.

Venturer has participated in other groundbreaking timber technology projects including exploring the use of regional wood to offset what is imported from other parts of the globe, and the adoption of highly efficient connections.

The world bank estimates by 2025 Mass timber will represent US\$ 1.4 billion of the global construction industry with demand growing exponentially year by year.

The lack of practical, economically viable and predictable treatments to bolster fire resistance is an impediment to even more uptake of the product, especially for legacy buildings and infrastructure like Airport terminals.

For more information, visit www.venturertimberwork.com