THE STRAITS TIMES

The Straits Times online, Thursday, 22 July 2021

NTU team comes up with cheaper, safer helmet for cyclists

The NTU team said the prototype is tougher, stiffer and less brittle than helmets with an outer shell made of polycarbonate. ST PHOTO: YONG LI XUAN

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PUBLISHED JUL 22, 2021, 1:57 PM SGT

SINGAPORE - Scientists from Nanyang Technological University (NTU) have developed a bicycle helmet that could be cheaper for cyclists, while offering them greater protection from accidents.

They say that their prototype, using a new thermoplastic reinforced with carbon fibre, is tougher, stiffer and less brittle than helmets with an outer shell made of polycarbonate.

"Our prototype helmet has been subjected to a barrage of internationally benchmarked tests and has demonstrated the ability to provide greater protection for cyclists compared with conventional helmets", said Associate Professor Leong Kah Fai of NTU's School of Mechanical and Aerospace Engineering, who led the team behind the prototype.

Speaking at a media briefing on Thursday (July 22), Prof Leong added that his team is exploring options to scale up the manufacturing process of the helmet, but it could be two to three years before the prototype is commercialised.

The helmet's outer shell is made primarily of Elium, a new thermoplastic resin, reinforced with carbon fibre. This composite allows the outer shell to absorb more energy on impact over a longer period of time, while dissipating it more evenly throughout the helmet.

As a result, less force is transferred to the user's head in the event of an accident and the risk of critical injury is reduced.

To ensure the prototype is safe across different scenarios, the team drove the helmet down at high speeds onto flat, rounded and pyramid-shaped anvils over numerous tests.

The tests are the same as those conducted by the United States Consumer Product Safety Commission (CPSC). The team said its prototype meets the CPSC 1203 certification, an internationally recognised safety standard for helmets.

Dr Bhudolia Somen Kumar, a research fellow at NTU and a member of the team, said they found that about 75 per cent of impact energy is absorbed by the foam layer of polycarbonate helmets, which is in direct contact with the cyclist's head.

In contrast, the outer shell of the team's helmet absorbed more than 50 per cent of impact energy, leaving less energy - about 35 per cent - for the foam layer to absorb.

Dr Somen said: "When the helmet hits a surface at high speed, we noticed that there is a deformation... which means the outer shell is taking more load and absorbing more energy.

"This is what you really want - the more impact absorbed by the shell, the less of it that reaches the foam, and so there is less overall impact to the head."

The thermoplastic resin Elium was developed by French speciality materials giant Arkema, an industry partner of NTU.

As Elium is liquid at room temperature and can be moulded without higher temperature processing, the team said its helmet is easier to produce.

Prof Leong said the prototype helmet would offer the same protection as high-end helmets on the market, but at the price of mid-tier ones, which cost between $100 and $150.

His team is also considering a range of other potential applications for composite materials that use Elium, such as in other high-performance sports equipment and in the electrification sector, he added.

The team, which includes research associate Goram Gohel and master's student Elisetty Shanmuga, is supported by the Agency for Science, Technology and Research under the Research Innovation Enterprise 2020 Plan.

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