TWO BREAKTHROUGHS IN SMART WINDOW GLAZING

EPFL RESEARCHERS HAVE DEVELOPED TWO TYPES OF WINDOW-GLAZING SYSTEMS THAT SET THE STAGE FOR A HOST OF NEW APPLICATIONS. THE FIRST ONE, WHICH LETS MOBILE PHONE SIGNALS PASS FREELY INTO TRAINS, IS ALREADY BEING USED BY RAILWAY COMPANIES. THE SECOND ONE IMPROVES THE DIFFUSION OF NATURAL LIGHT IN BUILDINGS AND HAS JUST RECEIVED PATENT PROTECTION FROM THE EUROPEAN PATENT OFFICE.

Researchers have long been fascinated by glass, a transparent yet durable material. It is used extensively in modern architecture and public transportation, making its composition a strategic issue in terms of costs and energy efficiency.

Thanks to two EPFL research projects, window-glazing technology has just made a major leap forward. The first project created a window-glazing system that improves mobile reception in trains. Bern-based railway company BLS has already installed this system in its new trains. The second project led to a technique that makes better use of natural light in buildings. The European Patent Office has just granted this one a patent, recognizing its innovative approach and paving the way for secure transfer to industry.

The two systems have one thing in common nanometric thin layers. By combining these new translucid materials with glass, the research team led by Andreas Schüler at EPFL's Solar Energy and Building Physics Laboratory (LESO-PB) was able to boost the performance of existing window glazing.

Their new smart glazing systems deliver better energy efficiency and are ideally suited to the growing use of connected objects. They also dovetail nicely with Switzerland's environmental objectives and today's lifestyles. The projects received financial support from the Swiss Federal Offices of Energy and Transport.

+ THE RESEARCHERS COMBINED TRANSLUCID, NANOMETRIC MATERIALS WITH GLASS.

BETTER VISUAL COMFORT AND ENERGY EFFICIENCY IN BUILDINGS

Window blinds may soon be replaced by a thin layer of micro-mirrors developed by the Nanotechnology for Solar Energy Conversion Group at LESO-PB. The researchers' system will allow builders to make better use of natural light within a given room and cut heating and cooling costs by 10-20%. In the summer, the micro-mirrors reflect light back outward, eliminating direct sunlight and avoiding overheating. In the winter, the micro-mirrors redirect the natural light into the building.

A high-precision laser is used to cut the micro-mirrors, which are embedded between the two layers of double-glazed windows and invisible to the naked eye. These windows are meant for building facades that are highly exposed to the sun. The design process took into account the need to keep costs down and make large-scale production feasible.

The micro-mirror glazing lasts longer than traditional slatted venetian blinds. And it works all by itself, since it is based on natural light and solar geometry without any mechanical constraints. The European Patent Office recently issued a patent for this system. It will be tested at the futuristic NEST house in Dübendorf (Zurich Canton) in 2017.

This project was supported and financed by the Swiss Federal Energy Office.

IMPROVED MOBILE RECEPTION AND THERMAL INSULATION ON TRAINS

Train travel may be fast, but mobile connectivity on board often lags behind. That's because modern train cars are essentially metal boxes that block out microwaves – in physics, this is called a Faraday cage. The waves are blocked by an ultra-thin metal coating that is added to train windows to prevent heat loss from infrared radiation. But EPFL researchers, working with manufacturing partners, have developed a new type of window that lets mobile phone signals through while maintaining a comfortable temperature for passengers.

The research team – the Nanotechnology for Solar Energy Conversion Group at LESO-PB – came up with the idea to breach the Faraday cage by modifying the windows' metal coating with a special treatment. Using laser scribing, they ablated some 2.5% of the metal coating's surface area. That allows the electromagnetic waves to pass through without sacrificing any of the glazing's thermal properties. And the resulting pattern cannot be detected by the naked eye.

Both laboratory and real-world tests were extremely promising. Bern-based railway company BLS has equipped three of its railcars with the new glazing as part of a renovation initiative to make its trains more energy efficient. Thanks to the researchers' technology, mobile reception is just as good in the railcars with the laser-treated windows as in homes with ordinary windows.

The next step will be to use the new window glazing in buildings, where the Faraday cage effect can also come into play.

This project was supported and financed by the Swiss Federal Transport Office.