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## **Professor Young Min Song's research team finds ways to prevent hot cars... develops eco-friendly cooling material (National Research Foundation of Korea)**

- A way has been found to relieve extreme overheating caused by the greenhouse effect in enclosed spaces such as cars.
  - GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) School of Electrical Engineering and Computer Science Professor Young Min Song' research teams has developed a structure made of eco-friendly materials that would lower the temperature of an enclosed space without an external power source.
- This is expected to serve as a starting point for application of materials for vehicle roofs to maintain pleasant indoor temperatures and also for the construction of heat-resistant devices to prevent the heating of electronic devices or buildings to save on cooling costs.
- In the form of a multilayer panel with a thickness of about 500  $\mu\text{m}$  made of polymer (PDMS), silver (Ag), and quartz ( $\text{SiO}_2$ ) in order from the top, it can create a cooling effect by covering the top of the space where the temperature is to be lowered.
  - By separating the radiation characteristics from the upper and lower surfaces based on metallic silver (Ag) that strongly reflects sunlight (more than 90%), the lower surface absorbs heat in a closed space and releases the absorbed heat

through the upper surface. This is why it was named the Janus emitter after Janus, the god of two faces in Roman mythology.

- Of course, there has been a cooling system that uses radiative phenomena, which are natural heat emitters. However, it was difficult to discharge heat from the space as it was only cooling the surface attached to release heat from one side of the surface.

- passive radiation cooling method: a cooling method that lowers the ambient temperature without external power supply by emitting long infrared rays through radiation

- When the developed cooling material absorbs heat inside the enclosed space in contact with the quartz structure placed at the bottom (broadband radiation), the polymer structure above it radiates in the form of electromagnetic waves while preventing this heat from being used to heat the surrounding air (selective radiation) to lower the temperature of the enclosed space.

- The results of measurements in an actual vehicle simulation environment showed that conventional passive radiation cooling material\* only lowers the 'surface' temperature whereas this material can reduce the temperature of the vehicle's 'interior' by 4°C from 43°C to 39°C.

- \* conventional passive radiation cooling material: aluminum (Al) substrate reflecting sunlight, an ideal broadband emitter made of 100 μm thick polymer (PDMS)

- This translates into a 10% reduction in automobile electricity consumption.

- Although this study used a Janus cooling plate with an area of 10 cm<sup>2</sup>, the research team expects that, due to the nature of infrared thermal radiation where the radiated energy increases in proportion to the area, it will have cooling effects even in areas with large volumes such as vehicles.

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