COOLESTSG WEBINAR: THE RACE TO INVENT WEARABLE PERSONAL COOLING DEVICES

Date: Friday 4 August 2022

Time: 15.00 - 17.00

Venue: Zoom

Speaker: Prof Sunmi Shin, NUS Department of Mechanical Engineering

The event is open to CoolestSG Consortium industry, IHL and RI members, its invited guests and government agencies. A Zoom link will be sent to registered attendees no later than two days from the event. For registration click **here** or scan the below QR Code no later than two days from the event.

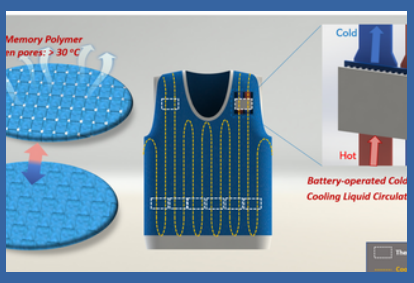

Photo: Courtesy Prof Sunmi Shin

Event Organizer: Cooling Energy Science and Technology Singapore - CoolestSG Consortium

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INTRODUCTION

Wearable personal cooling devices have in the past primarily been air-cooled clothing that actively cool down workers in areas where air-conditioning systems cannot be easily installed, such as tunnels and underground construction sites.

Air-cooled clothing on the market does not operate by actually cooling down the air, as a room AC units do. Instead, it increases the natural body cooling of the wearer by blowing air and sometimes water vapor around the body, decreasing skin temperature by the evaporation of sweat and vapor. Patents for air-cooled clothing have been around for years, but few products have actually made it to market.

One advantage of wearable personal cooling devices is that it requires much less energy to cool people down than to cool down their entire environment. In some cases, the purpose of air conditioning is not to cool down the objects in the room, but the people. Directly cooling the people is therefore far more efficient.

In addition to the energy used, a 2012 New York Times article reported that gases commonly used in air-conditioning absorb some 2,100 times (The Global Warming Potential for R-410 commonly used in split units in Singapore is 2,088) more infrared radiation per ton than carbon dioxide. Although there are refrigerant gases on the market with far lower GWP than the above mentioned, for example the mildly flammable R-32 with a GWP of 677 that is being introduced in Singapore for split units and the mildly flammable R1234ze with a GWP of 1-7. which is suitable for and increasingly used for larger systems, it will take time for such gases to be adopted all across the world and you still have some global warming potential for such refrigerant gases if leaked to the atmosphere.

Due partly to the increasing use of air-conditioning in the developing world and an increased temperature as part of the global warming, particularly in Southeast Asia and South Asia, as most recently reported from India with surface temperature topping 60 degrees in some parts of north India, air conditioning is projected to contribute to some 27% of the overall greenhouse gas emissions by 2050.

In this webinar, Prof Sunmi Shin will give an overview of the development of wearable personal cooling devices and share with attendees some details about the research she has done in Singapore and the USA and what further research in this area she would like to pursue going forward.

PROGRAM OUTLINE

14.55	**Admittance of attendees**
15.00	**Introduction**
15.05	**Presentation by Prof Sunmi Shin, NUS Department of Mechanical Engineering**
16.00	**Q&A**
16.20	**Closing of Event**
16.30	**End of Event**

ABOUT THE COOLESTSG CONSORTIUM

CoolestSG is a national consortium set up at NUS in 2018 with funding support from NRF. The task of the CoolestSG Consortium is to bring stakeholders together to catalyse co-development between researchers and industry of novel low-energy cooling technologies and/or passive/integrated designs and to translate research into deployment and commercialisation with the aim to promote Singapore as a frontrunner in cooling technologies.

Screenshots may be taken during this webinar which will be recorded.

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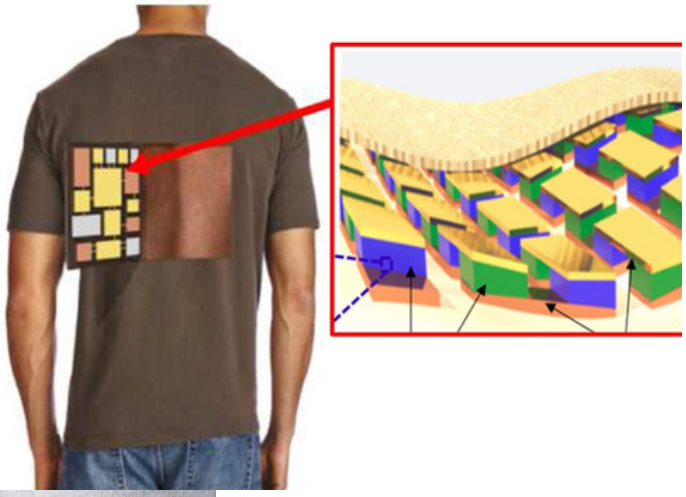
ABOUT THE SPEAKER

Prof Sunmi Shin is as an assistant professor at NUS Department of Mechanical Engineering. She joined NUS in 2019. Prior to joining NUS, she received her Ph.D. in Materials Science and Engineering from UC San Diego in 2019 under the supervision of Prof. Renkun Chen, and her B.S. and M.S. degrees in Chemical Engineering from Hanyang University in 2011 and 2014, respectively. She specializes in an experimental investigation on fundamental nanoscale heat transport for thermal management and development of personalized thermo-regulators and energy harvesting devices using thermoelectric energy conversion. Her research interests include a multidisciplinary approach for efficient and active heat control across mechanical engineering and materials science. She is also the recipient of awards including, Global Young Investigator Award by ACerS (2022), MIT Technology Review Innovators Under 35 in Asia Pacific (2021), Women-in-Science & Technology Award, KSEASG (2021) and Chancellor's Dissertation Metal (2020).

Modules Taught
ME2121 Engineering Thermal Dynamics and Heat Transfer (2021 – present)
ME4225 Applied Heat Transfer (2020 – present)
ME6204 Advanced Heat Transfer (2022 – present)

Research Interests
heat; super-Planckian thermal emission; thermoelectrics; cooling; personal thermoregulation; nanomaterials

Prof Sunmi Shin, NUS Department of Mechanical Engineering



ABOVE LEFT: The Reon Pocket launched in 2020 by Sony, sits at the back of the neck in a specially designed undershirt's pocket and delivers instant cooling thanks to a property of semi-conductors called the Peltier effect.
(Photo: Courtesy Sony)

ABOVE RIGHT: Concept for wearable thermoelectric devices.
(Photo: Courtesy Prof Sunmi Shin)

LEFT: Embr Wave from Embr Lab is a device that you wear on the inside of your wrist. At the press of a button, a ceramic plate that sits next to your skin gets really cold, giving a bit of relief by targeting the sensitive thermo-receptor nerves on the inside of your wrist.
(Photo: Courtesy Embr Lab)