Supplementary Materials

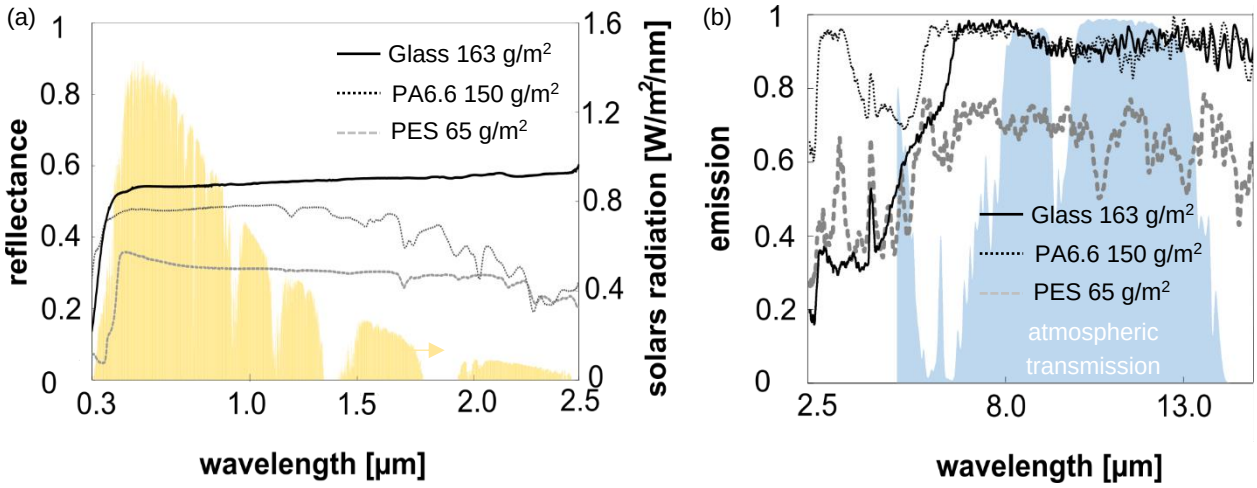
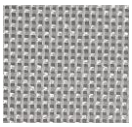


Figure S1. Spectral curves of the uncoated substrate textile materials. (a) Spectral reflectance in the solar range; (b) Spectral emission in the mid infrared range.

Table S1. Specifications of the textile fabrics used as the substrate material.

Fiber material	Fabric Type	Weight per area [g/m²]	Thermal Conductivity [W/m²K]	Manufacturer	Identification
100% PA6.6	 Plain Weave$^{1/1}$	150	28,63±0,12	Indorama Ventures Mobility Group – Fibers division (formerly UTT)	PA6.6 150
100% PES	 Plain Weave$^{1/1}$	65	10,89±0,08	Indorama Ventures Mobility Group – Fibers division (formerly UTT)	PES 65
100% E-Glas	 Twill$^{2/2}$	163	43,00±0,25	HP-Textiles GmBH, Germany	Glas 163

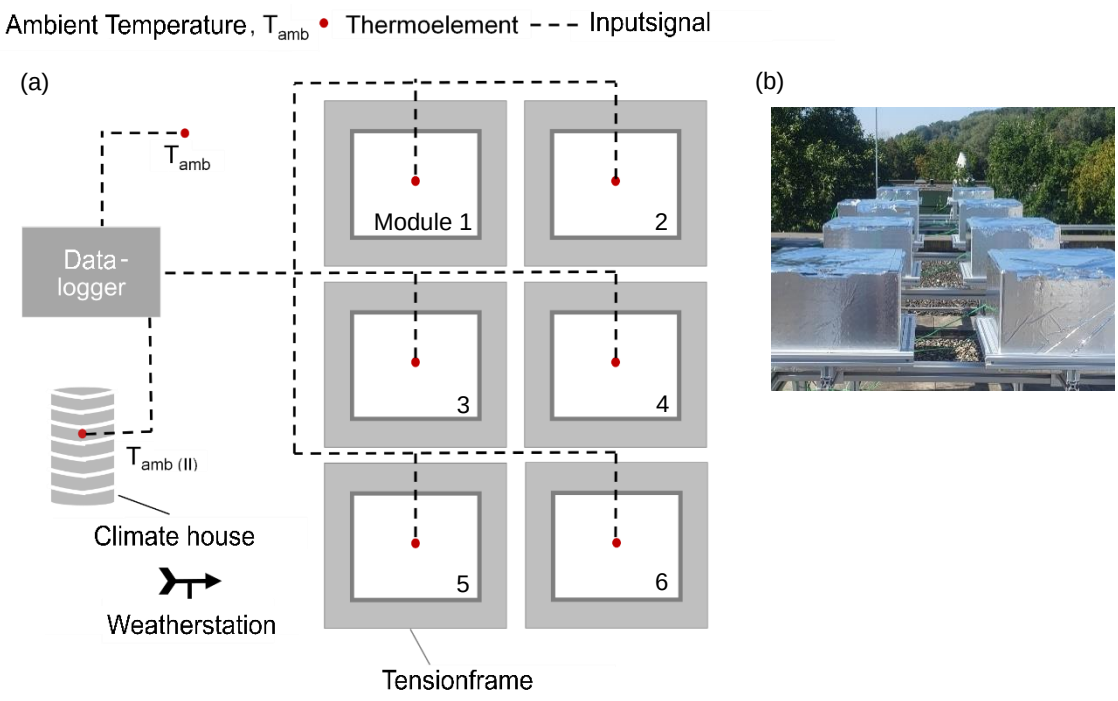


Figure S2. Setup of the test modules for comparing different materials and measuring temperature differences. (a) Schematic diagram of the six test modules, highlighting the system components, data acquisition and control system; (b) Photograph of the system on the institute roof (the modules are covered with aluminum foil before measurement until a steady-state temperature is reached).

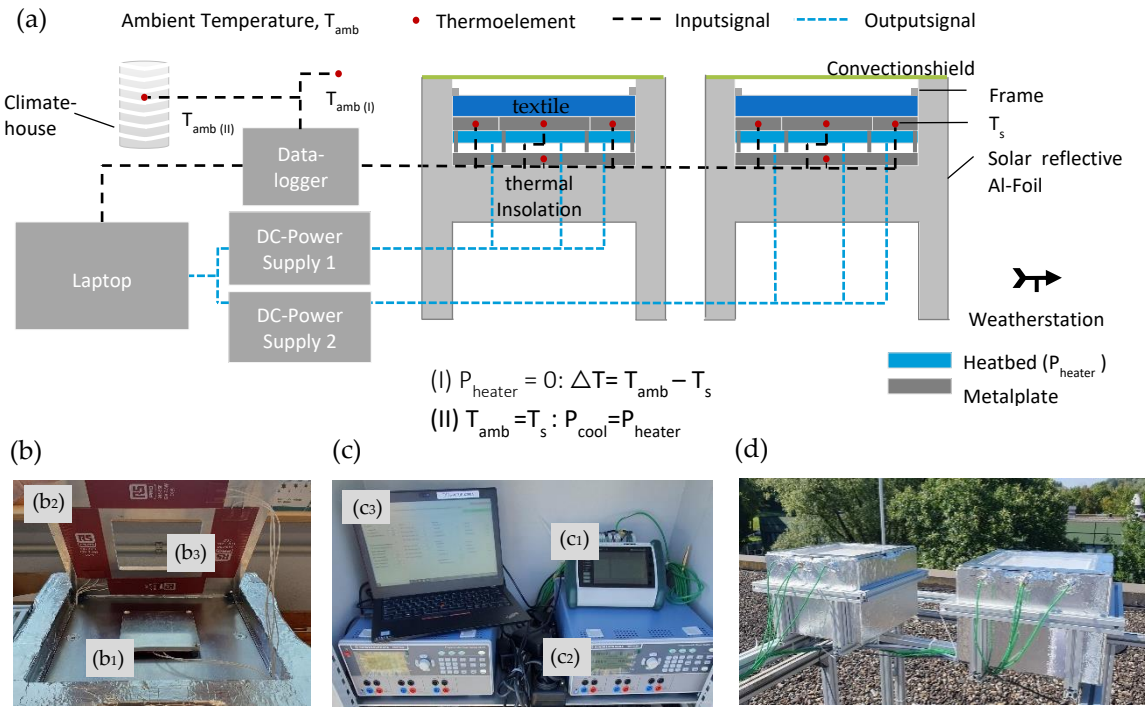


Figure S3. Assembly of the test modules for measuring cooling performance in Celsius and W/m² using a feedback-controlled heating plate system. (a) Schematic representation of the cross-sectional view of the test modules, showing the system components, data acquisition, control system, and the position of individual components and thermocouples. (b) Photograph of the "Guarded-Ring" heating plate system, (b_1) Core plate, (b_2) Frame plate, (b_3) Heatbeds. (c) Photograph of the data acquisition, (c_1) Data logger, (c_2) DC power supplies (1 & 2) for each test module, (c_3) Data acquisition and control of heating power; (d) Photograph of the test modules on the institute's roof.

The sample is tensioned between the inner side of the insulation box and a tension frame, so that it lies flat on the aluminium metal plate achieving good conductivity between the textile and the metal plate. The distance between the frame and core plate is 5±0.5 mm. The frame plate has an area of 456±0.5 cm².

A lower metal plate, which is inserted with a distance of 5±0.5 mm to the core and frame plate, serves as a support for the upper plates. The distance between the convection shield and the sample surface is 15±0.5 mm.

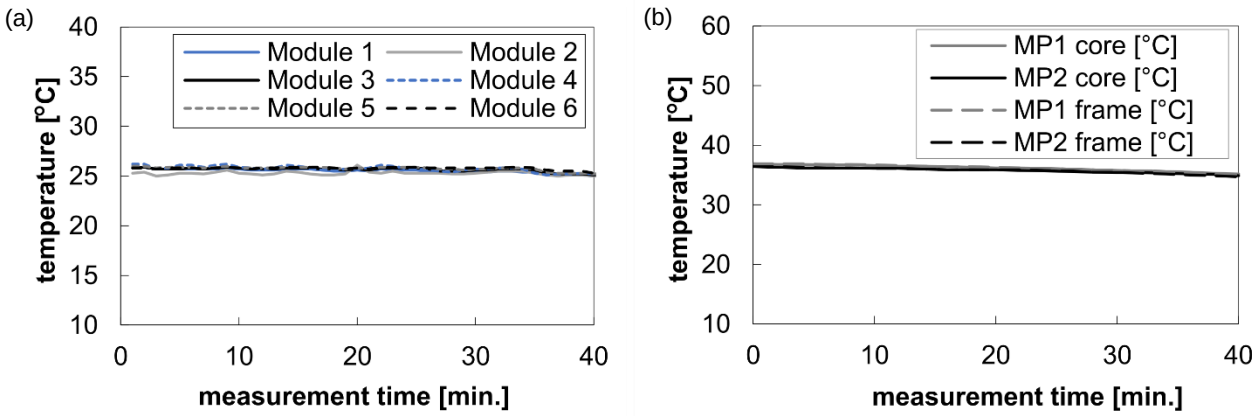


Figure S4. Comparison of the test modules. Temperature measurement over a period of 40 minutes with identical sample usage (aluminium foil). (a) Comparability of the test modules for pure temperature measurement on 19.09.2023, 17:05 - 17:45, average solar irradiance: 332.8 W/m2, the temperature of the test modules are at a constant level, the standard deviation is 0.2 °C; (b) Comparability of the test modules with heating plate system on 27.09.2023, 17:05 – 17:45, average solar radiation intensity: 350.8 W/m², frame and core temperatures remain at a constant level, the standard deviation is 0.3 °C.

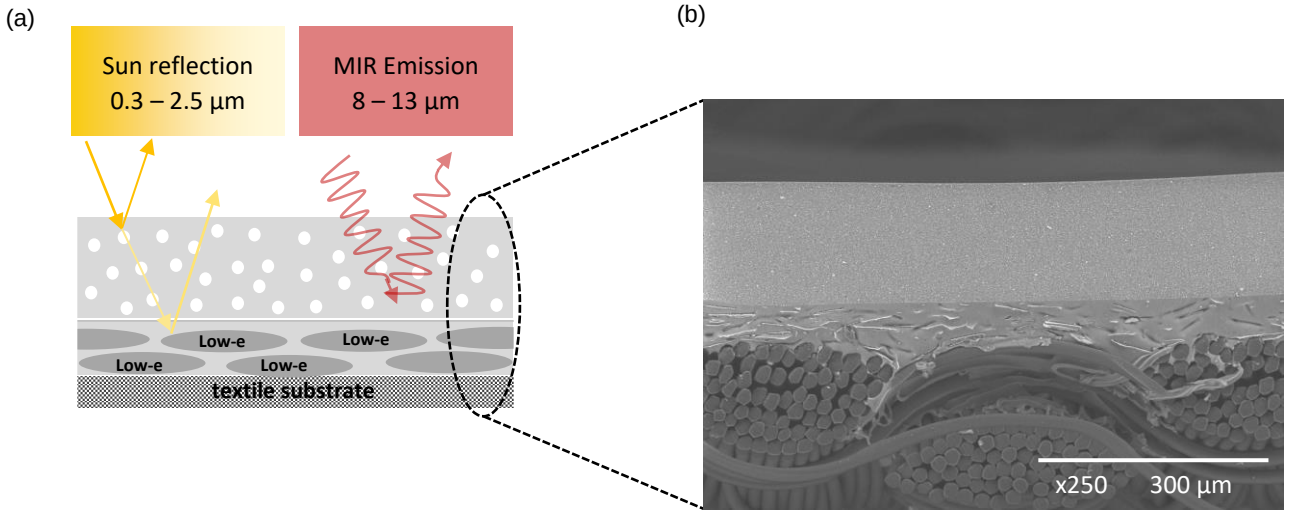


Figure S5. Optical representation of the microstructure and the structure of the coating. (a) Schematic representation; upper layer with sun-reflecting white pigments, lower layer with low-e particles that specifically reflect heat in the near infrared and provide an impermeable layer, ensuring substrate independence even with low layer thicknesses. (b) SEM image of the coated textile (PA6.6 150 g/m², layer thickness: 1st layer: 65.84±11.36 µm, 2nd layer: 194.39±5.97 µm) (Hitachi TM1000)

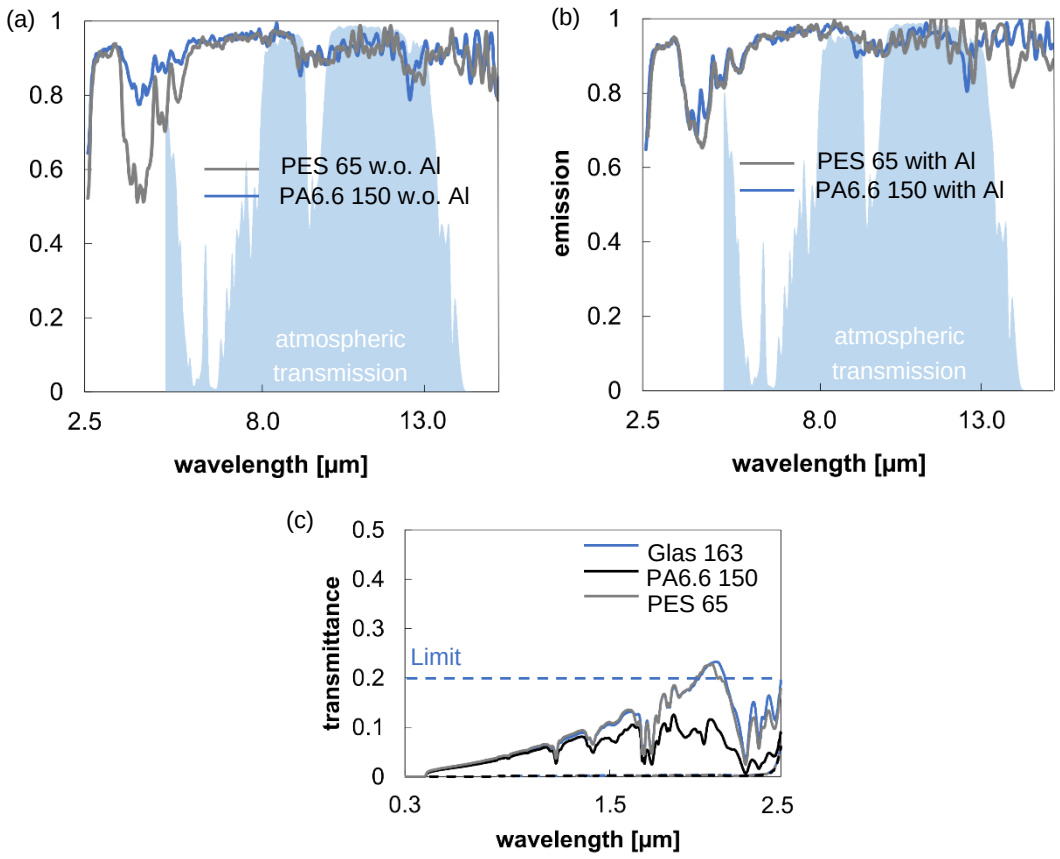


Figure S6. Spectral investigation and advantages of the aluminium (Al) particle integration compared to the reference system without aluminium particles. (a) Emission in the MIR of the reference coating without Al integration on PES 65 g/m² and PA6.6 150 g/m²; (b) Emission in the MIR of the coating system with aluminium particles on PES 65 g/m² and PA6.6 150 g/m²; (c) Solar transmittance of the reference coating compared to the coating with aluminium particles, dashed lines = coating with Al, solid line = coating w.o. Al.

(a) Cooling Textile

(b) Ref. Architecture Membrane

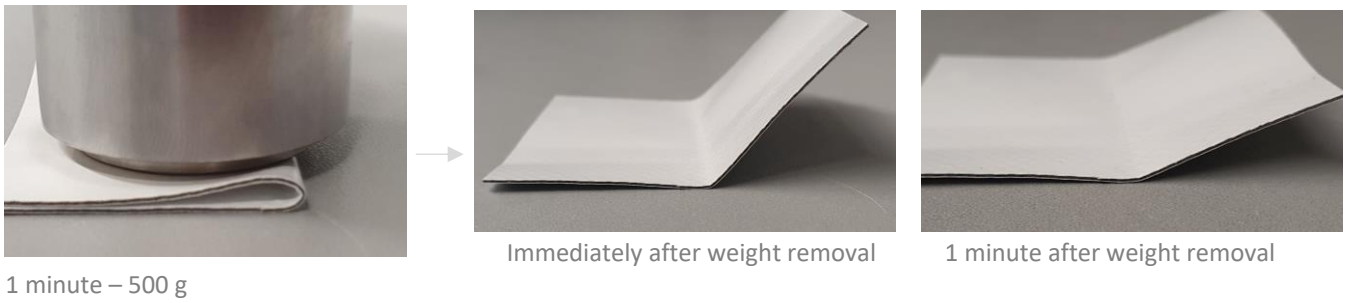


Figure S7. Flexibility test. (a) Cooling Textile: Glass 163 g/m², layer thickness: 1st layer: 60.52±18.14 μm, 2nd layer: 187.80±3.46 μm. (b) Commercially available architecture membrane, coating on Glass