Smart Antibacterial Janus Fabric Fased on PVDF/Ag-decorated-MXene for Unidirectional Water Transport and Thermal Management

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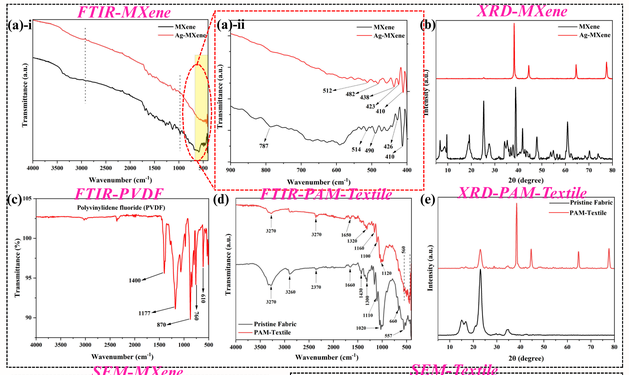
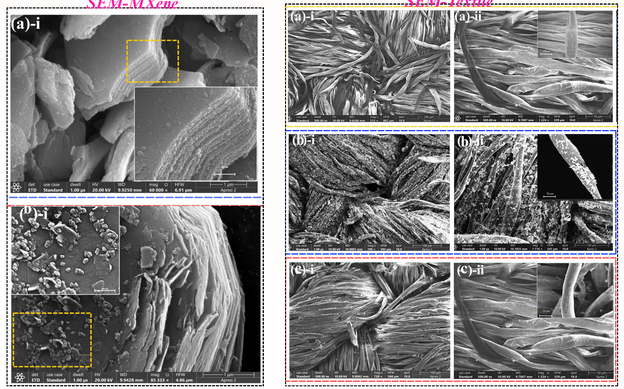
Introduction

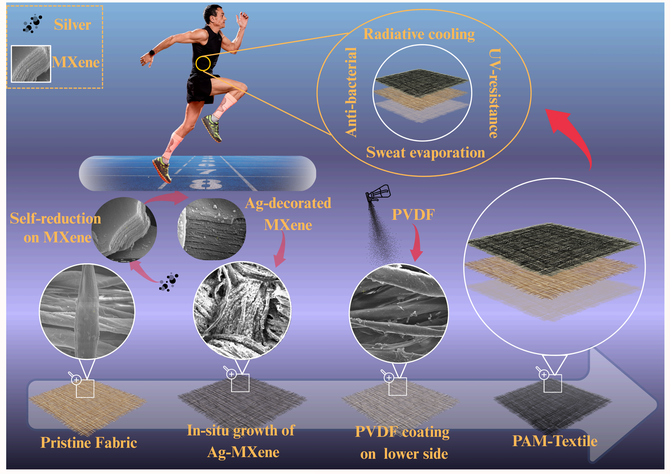
- Personal comfort in wearable textiles requires antibacterial action, moisture regulation, and thermal management.
- This study developed a Janus fabric (PAM-Textile) combines hydrophobic PVDF and hydrophilic Ag@MXene layers for rapid one-way sweat transport and a dry, breathable microenvironment, with thermal cooling.

Characterizations

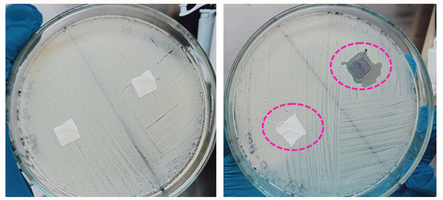




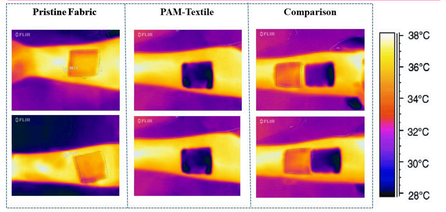
Synthesis Scheme



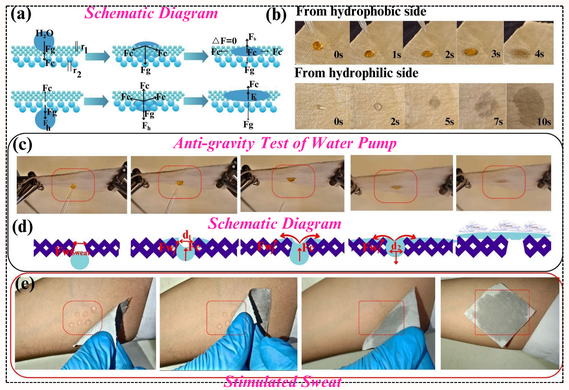
Antibacterial Studies

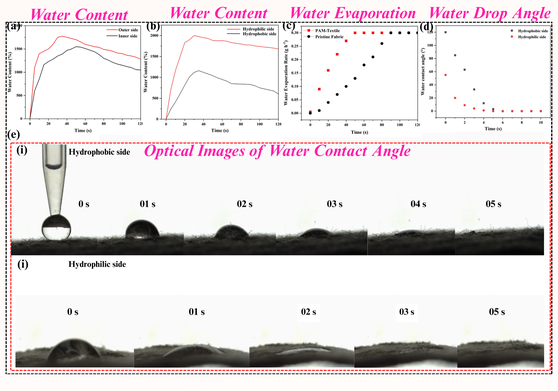


IR Thermal Images

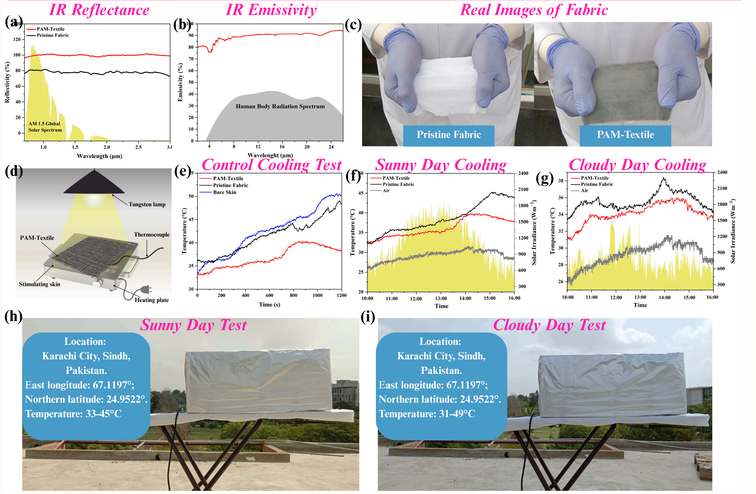


Unidirectional Water Transport





Radiative Cooling Performance



Conclusion

- PAM-Textile enables rapid one-way sweat transport (UMCI 697.11%, WCA 120°→0° in 4 s) and provides passive radiative cooling, reducing skin temperature by up to 12 °C.
- Offers strong UV shielding (UPF 25) and broad-spectrum antibacterial activity (≥99% MRSA inhibition) with no bacterial colonization observed.
- PAM-Textile supports UN SDG 3 (Good Health and Wellbeing) by improving hygiene, comfort, and protection in wearable applications.
- Retains multifunctional performance after 10 wash cycles and 20 abrasion cycles, making it a practical solution for wearable applications.

References

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- Yan, Zhen, et al. "Bioinspired metafabric with dual-gradient janus design for personal radiative and evaporative cooling." Advanced Functional Materials 35.2 (2025): 2412261.
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