Flexible High Thermal Conductivity Fabrics for Applications in Wearable Electronic Devices

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Objective
Characterize effective thermal conductivity and bending behavior of fabrics constructed from high thermal conductivity polymer fibers

Approach
- Review and identify high thermal conductivity polymer fibers
- Develop methodology for thermal characterization (based on IR thermography) and bend testing (based on standard ASTM techniques)
- Develop a reduced-order model to predict fabric thermal conductivity as a function of weave parameters

Impact
- Developed a novel steady-state measurement technique for in-plane thermal characterization
- Achieved high fabric in-plane thermal conductivity compared to conventional fabric materials
- Assessed application of high conductivity polymers to aid in the thermomechanical design of flexible/wearable heat spreaders

Publications
A.A. Candadai, J.A. Weibel, and A.M. Marconnet, IEEE ITHERM, May 2019. DOI:10.1109/ITHERM.2019.8757385

In-plane thermal conductivity of UHMW-PE (Dyneema) fibers, yarns, and fabrics measured using infrared thermography

Nano/Micro-Fibers
Macroscale Fabrics

Schematic drawing of the setup used to characterize in-plane thermal properties of the high thermal conductivity fabrics based on Fourier’s Law and energy balance