Passive Thermo-Adaptive Textiles With Laminated Polymer Bimorphs

Brent Ridley, PhD
Technical Lead
Senior Research Scientist
Founder of Kovio
Chemistry Professor, Biola University

Duration of Award: 2 years

Saul Griffith, PhD
Technology to Market Lead
CEO
Founder of Makani Power
Founder of Instructables
Founder of Sunfolding
Founder of Volute
Author of HowToons

Shara Maikranz
Modeling + Analysis Research Engineer
Volute

ARPA-E DELTA Program Kickoff
May 21-22, 2015
Description of Technology

Dynamic Response from Passive Change
Polymer bimorph fibers, ribbons, sheets, and coils bend in response to temperature changes.

Multilayer bimorph structures can be constructed with coupled mechanical displacement along a single axis, enabling thickness variation in fabrics.

Above: Simple polymer bimorph
Below: Mirrored bimorph structure fabricated from simpler bimorphs
**Value Proposition**

**Comfort + Energy Savings**
Thermally adaptive clothing strives to be more comfortable, promising to reduce the >10% of domestic energy dedicated to heating and cooling buildings.

Multilayer bimorph structures can employ the commodity polymers already used in the apparel industry, but fabrication techniques will need likely need to be developed for low-cost production.

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Validation Plan

Technical Milestones

There are three primary areas of development in the proposed work:

1. Computational modeling of individual bimorphs (Q1+2) and collections of bimorphs (Q3+5) to guide multilayer structure design

2. Prototyping individual bimorph fibers, ribbons, sheets, and/or coils (Q1+2) and prototyping multilayer bimorph fabrics (Q4+6)

3. Optimizing material design for performance and manufacturability (Q5+8)

Connection between all three – simulation, prototyping, and iterative design – will be key for technical success

In addition to performance and market factors, both testing and manufacturing will be vital for commercial success

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Community

Assistance Welcome

Otherlab’s numerous and varied projects ensure that there are a range of experts around for consultation. Still, we regularly and enthusiastically collaborate with others. We would love to hear from you about:

Market Strategy and Survey // value chain, product identification
Strategic Partnership // investment, materials and thermal analysis
Manufacturing // roll-to-roll, membrane, multilayer
Materials // selection, polymer adhesion
Hiring // materials, mechanical