

MULTI-FUNCTIONAL SOLUTIONS

Back Pain Patch Heating Element Design Team Finds Selectively Plated Fabric as Compelling Alternative to Wire-based Concepts

CASE STUDY

BACKGROUND

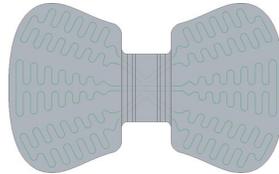
Medical heating patch designers striving to improve battery-powered heating elements face issues on two fronts. In the quest to help bring relief to millions suffering from back pain, older, wire-based designs have created performance issues for designers and disadvantages affecting consumers. In some respects, design innovation has lagged. When improvements have emerged, some have led to cosmetic issues often unpopular with users. Recently, one component designer serving medical device manufacturers not only faced these issues but also had discovered its current suppliers could not deliver an effective or complete answer.

CASEBOOK SITUATION

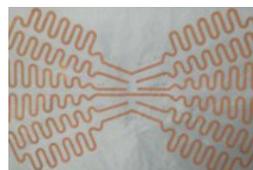
Certain wire-based designs for heating circuits will increase element thickness and weight. Some have been found to deliver unstable performance. The disadvantage involving wire thickness also had a disadvantage for consumers: Wiring and wire patterns were noticeable through the heating patch's thin layers of fabric covering them. For cosmetic reasons, users often desired to see a smooth-looking outer fabric - with no wire patterns showing through. No supplier was stepping forward and the component maker was finding answers to be elusive.

RESOLUTION

Thankfully, some initial solutions surfaced during a visit with a new source, **Laird Performance Materials**. The global company leads in advancements in the material sciences. Innovations can simultaneously resolve performance issues affecting components using multi-functional solutions incorporating a single process design. Today, a very recent Laird innovation which has excited the component maker's design team is being analyzed to replace wire-based heating elements.



Initial concept



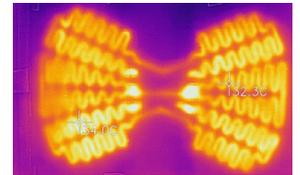
Laird heating element prototype

IMPLEMENTATION

To improve its design of a layered, stack-up heating element to be used in a battery-driven back pain product placed directly on the skin, the manufacturer looked to Laird for a complete answer. Each half of its heating patch has three separate heating circuits. Each circuit is designed for 2-2.5W and 10-15 Ohm/meter. Traces length is 40-50cm. At one point the original concept for the stack-up, to be connected to the PCB, featured a polyurethane (PU) bio layer, a polyester spunbond (PES) nonwoven fabric layer, the heating element's copper-nickel wire (11x0,05mm) and another PU bio layer with skin contact. Unfortunately, the original design had both performance and assembly issues. Batteries tended to overheat. On the assembly floor, extensive soldering was required. Laird, which had recently announced its capability to produce selective plating and high electrical conductivity onto both sides of standards or stretchable fabrics, recommended a unique concept - and no more wires. Against the skin, the heating element's stack-up would include air-breathable PU film as the biocompatible layer. **Laird selectively plated fabric** would become the active heater structure versus wires. Polyethylene terephthalate (PET) nonwoven fabric at 0.5-2mm would be the insulation layer. PU film would become the cosmetic or outer layer. The heating element would be consolidated using **Laird LT591 pressure-sensitive tape**.

RESULTS

The arrival of Laird as expert consultant and prospective supplier has been welcomed throughout the design team. After testing, and aside from a few isolated hot spots found in initial samples which have been improved subsequently, Laird and the manufacturer now believe the application of selectively plated fabric instead of wire for the active heating structure could deliver stable circuit patterns, even out temperature variations and lead to greater overall heating element performance.



Customer Test



Selectively plated fabric