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Measurement of Heat Transfer Coefficient of Fabric

Why is it important to understand the heat transfer coefficient of fabrics?

The well-being of humans largely depends on clothing (i.e. textiles). Wrong clothing leads to discomfort and in extreme cases to hypothermia (overcooling) or hyperthermia (overheating). If a person loses too much energy it leads to overcooling, if energy cannot leave the body, it leads to overheating.

The organ which is responsible for the heat exchange between a human body and the environment is the skin. As the same time, skin acts as the sensor which measures the heat transfer. It can, for example, create the feeling of freezing, which is a signal to tell a person that too much energy is being lost. The heat transfer between skin and the environment is influenced by clothing. Understanding the effects of different textiles on this heat transfer is crucial for the design of functional high-tech materials (e.g. firefighting protective gear).

“We use the gSKIN[®] Heat Flux Sensors to characterize our thermo-regulating fabrics we develop based on a variety of technologies. The sensors are very easy to use, and deliver great experimental insights. Measuring heat flux helps us creating better fabric materials faster.” – Dr. Özgür Çobanoğlu, Technology Development Group, ISKO division of SANKO Textile

The six thermal comfort factors

There are six factors which influence the thermal comfort of a person.

Personal factors (can be influenced)

- Metabolic rate (i.e. heating power of the person)
- Clothing level (i.e. the heat transfer coefficient)

Environmental factors (cannot be influenced)

- Air temperature
- Radiant temperature
- Wind
- Humidity

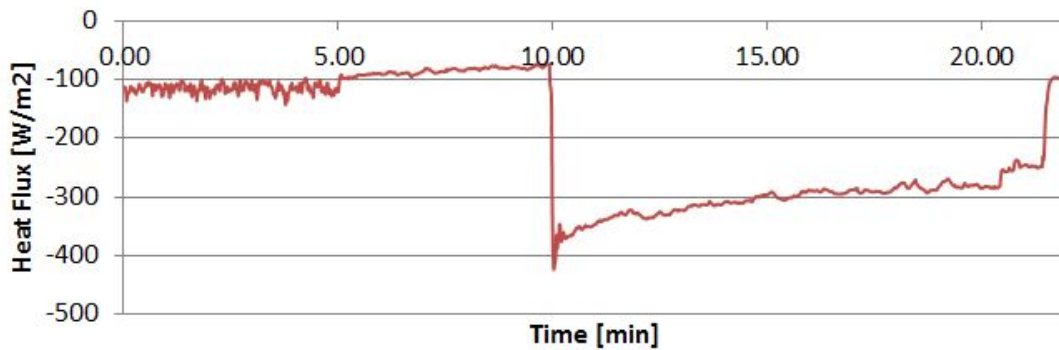
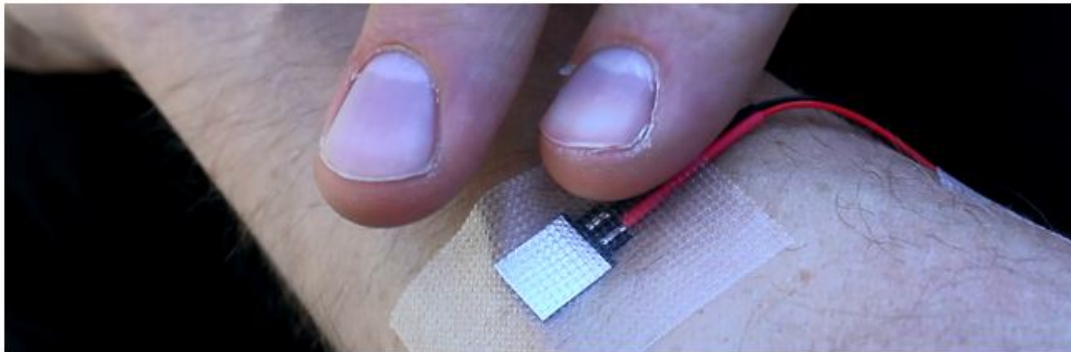


How to determine the heat transfer coefficient of fabrics

Most textile researchers and developers rely on laboratory type tests. These tests are standardized according to norms (e.g. ASTM D1518 “Standard Test Method for Thermal Transmittance of Textile Materials”). The tests are conducted in highly controlled environments and thus, produce repeatable results. While these tests offer great benefits (reproducible results, results of different textiles comparable, etc.), they do not fully describe the quality of a fabric under real conditions.

Standardized fabric tests do not fully describe the quality of fabrics under real conditions.

In situ measurements (i.e. measurement on a real human body in real conditions) are a great method to fully understand fabric quality in real conditions. gSKIN[®] Heat Flux Sensors are highly suitable for these types of in situ measurements of heat transfer coefficients.



How to use gSKIN[®] Heat Flux Sensors

Using gSKIN[®] Heat Flux Sensors for the measurement of heat transfer coefficients of fabric is simple. After identifying of the spot of interest, the sensor is applied using skin-friendly tape. For read-out of the sensor signals, we recommend using our data loggers (see link at the bottom of page). Then, the data logger should be wired in such a way that the test subject can move freely. The data logger will log all heat fluxes (in W/m^2), which can then be evaluated after the experiment.

gSKIN[®] Heat Flux Sensors for Textile Research and Development

An array of different products for R&D of textiles. These include heat flux sensors in different sizes and data-loggers for fast and reliable data acquisition. Sensors are always calibrated and have a cable connection.