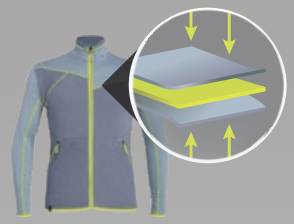
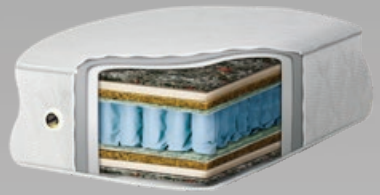
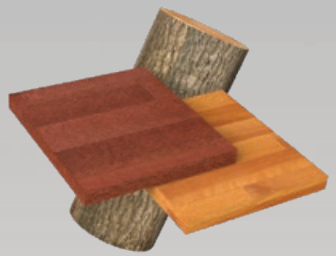




TEXTILES/ FABRICS



SOLIDS

TPS-EFFusivity Meter

Conforms to standard ASTM D7984-16

Thermtest
PORTABLE

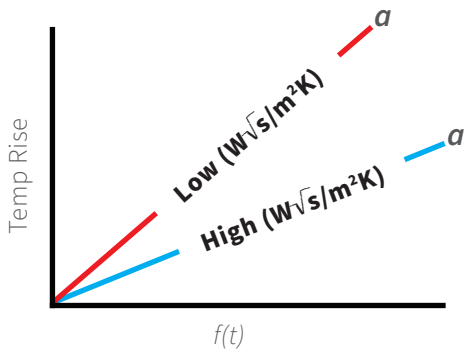
FEATURED **TPS-EFFusivity METER** CAPABILITIES

Thermal Effusivity ($W\sqrt{s}/m^2K$) is described as a materials ability to exchange heat with its surroundings. Surface haptics is a branch of psychology, describing the sense of touch, localized to the skin surface. The feeling of warmth and coolness (thermal effusivity) makes up the feeling of comfort, or the desired effect, which goes into the touched material surface. This is an important field of measurement for textiles, fabrics and solids.

The TPS-EFF (Transient Plane Source-EFFusivity) is a portable meter for direct determination of thermal effusivity of textiles and other low effusivity materials, in accordance with ASTM D7984-16. With a single measurement of 2 or 10 seconds in duration, materials can be accurately measured for thermal effusivity. The TPS-EFF uses a single-sided 30 mm diameter TPS sensor and short test times, to ensure one-dimensional heat flow. During the measurement, the sensor is heated using a constant current source, while the temperature rise of the sample is simultaneously recorded with time, by monitoring the change in electrical resistance of the wire spiral. The slope of temperature against a special function of time, is used to calculate the thermal effusivity of the material. For materials of relatively high effusivity, the slope will be lower, than materials of low effusivity.

$$e = \frac{P}{S\sqrt{\alpha_b}} - e_b$$

e = Thermal Effusivity ($W\sqrt{s}/m^2K$)
P = Constant Power (Watts)
S = Slope
α_b = Backing Material Diffusivity (mm^2/s)
e_b = Backing Material Effusivity ($W\sqrt{s}/m^2K$)



Mathematically, thermal effusivity equates to the square root of the product of thermal conductivity (W/m•K), Density (kg/m^3) and Heat Capacity (J/kg•K). For certain materials, like textiles, there are often other modes of heat transfer, such as convection and radiation. These modes of heat transfer alter the **thermal conductIVITY** to **thermal conductANCE**. The resulting term used for measurement of materials like this is referred to as **Thermal Effusance**.

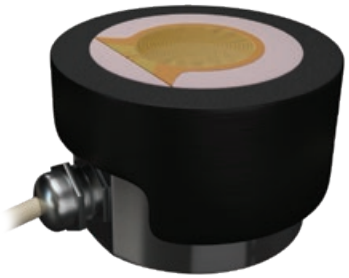
- **Follows international standard ASTM D7984-16**
- **Portable, Economical, and Accurate**
- **Easy to use**
- **Test time 2 and 10 seconds**
- **No user calibrations required**

TPS-EFF. METER SPECIFICATIONS

Materials	Textiles, Fabrics and Solids
Measurement Capabilities	1-Dimensional
Thermal Effusivity Range	35 to 1700 $W\sqrt{s}/m^2K$
Measurement Time	2 and 10 seconds
Reproducibility	2%
Accuracy	5%
Temperature Range [1]	-10 to 50°C
Minimum Sample Size	35 mm diameter x thickness dependent on Effusivity
Maximum Sample Size	Unlimited
Moisture Range	0 to 90% (non-condensing)
Sensor Diameter	30 mm
Standard	ASTM D7984-16
Test Method	Transient Plane Source (TPS)

[1] *Requires cooling/heating apparatus.*

ECONOMICAL. **PORTABLE.** ACCURATE.



STANDARD TPS-EFF SENSOR

The TPS-EFF comes with a standard 30 mm diameter, single-sided sensor for testing textiles, fabrics and solids. The spring loaded sensor can be used in two testing configurations; sample on top of sensor, or sensor on top of sample. At the push of a button, samples can be measured at 2 and 10 second test times. The additional 10 second test time allows for superior characterization of materials feeling of warmth, or coolness. Ambient temperature and results are conveniently displayed on the test screen. Results can then be saved and exported to Excel.

COMPRESSION, HUMIDITY AND TEMPERATURE

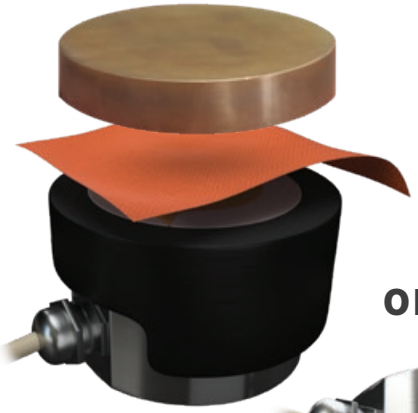
Several application and environmental specific conditions can affect the thermal effusivity (feeling of warmth or coolness) of a material. When used with a compression stand and environmental chamber, the TPS-EFF is able measure the effect of compression, humidity and temperature on a materials thermal effusivity.

SAMPLE MEASUREMENT

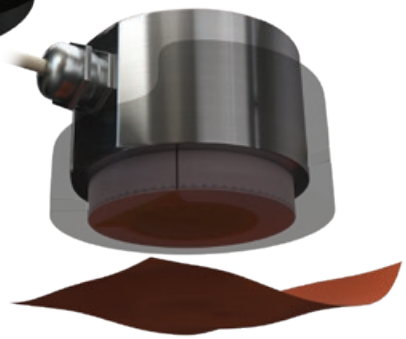
STEP 1

Using the TPS-EFF, samples of unlimited size can be tested, sample should be at least 30 mm in diameter to allow contact with TPS-EFF sensor. Measurement on various textiles, fabrics and solids are possible. Care should be taken to ensure sufficient thickness of sample, the divergence technique may be used to confirm this.

< 1 min.



OR



STEP 2

Once a sample has been prepared, measurements may be configured in one of two ways; sample placed on top of sensor, or sensor placed on top of sample.

< 1 min.

EFFICIENCY WITH EASE

STEP 3

From the portable TPS-EFF, a test time of 2 or 10 seconds may be selected and test activated with the push of a button.

< 1 min.

STEP 4

With included TPS-EFF Utility Software, results can be downloaded to windows computer for review and export, via USB connection.

1 min.

EFFUSIVITY - EFFUSANCE OF TEXTILES, FABRICS AND SOLIDS

As the measured thermal effusivity of textiles and fabrics encompasses various modes of heat transport (conductivity, convection and radiation), the results are referred to as thermal effusance. The measurement of solids, where the main heat transport property is thermal conductivity, results are properly referred to as thermal effusivity.

WARM — COOL

35 – 200

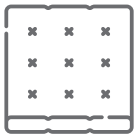
- Polyester Wadding (100%)
- Knit Wool Cashmere
- T-Shirt (85% Polyester | 15% Elastane)
- Water Content Cotton (2%)

200 – 400

- Jacket Outer-Layer (85% Polyester | 15% Cotton)
- Water Content Cotton (8%)
- Teak Wood

400 – 600

- Softwood Floor
- Water Content Cotton (10%)
- Mattress Contact Layer

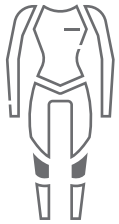


600 – 800

- Neoprene 30

800 – 1000

- Neoprene 80

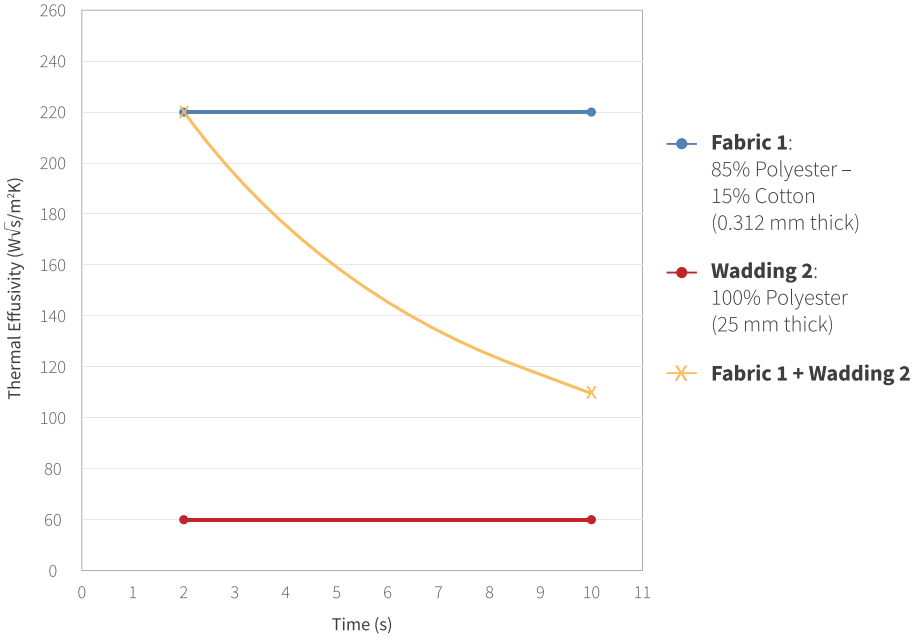


1000 – 1700

- Saturated Wool (90%)
- Glass

TEST TIMES TO SIMULATE TOUCH TIME

To simulate the feeling of prolonged cool to touch sensation, each material was prepared in sufficient thickness and individually measured for thermal effusivity at 2 and 10 seconds. This experiment was then repeated by layering Fabric 1 on top of Wadding 2. Results of the experiment show with sufficient thickness, an individual material feels the same at different touch - test times, different from material to material. Additionally, when one layer of higher effusivity material, Fabric 1, is placed on top of a lower thermal effusivity material, Wadding 2, the different touch - test times shows a decreasing feeling of coolness with time. This testing capability allows TPS-EFF users to layer different types of materials, to achieve a desired feeling of coolness, or warmth, with varying touch times.



Notes:

Your local distributor

HEADQUARTERS

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