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# Test Report of Graphene Textile

Graphage®

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# Graphene Textile

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# Q-max test

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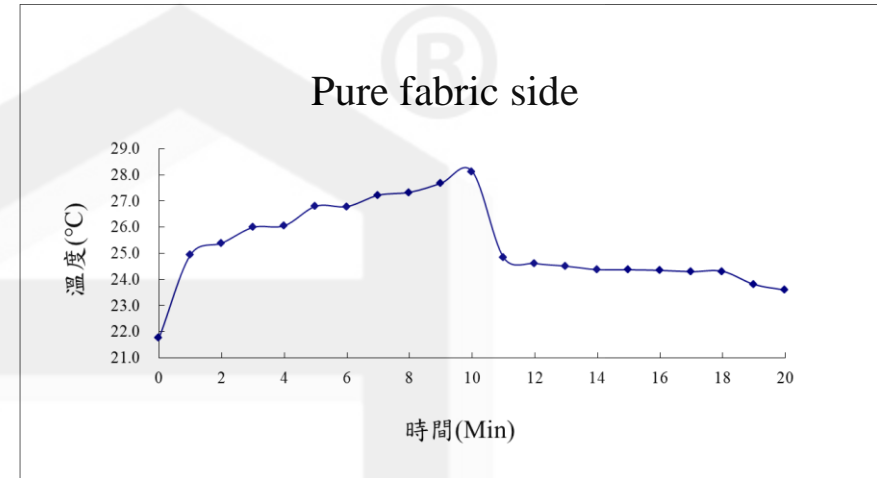
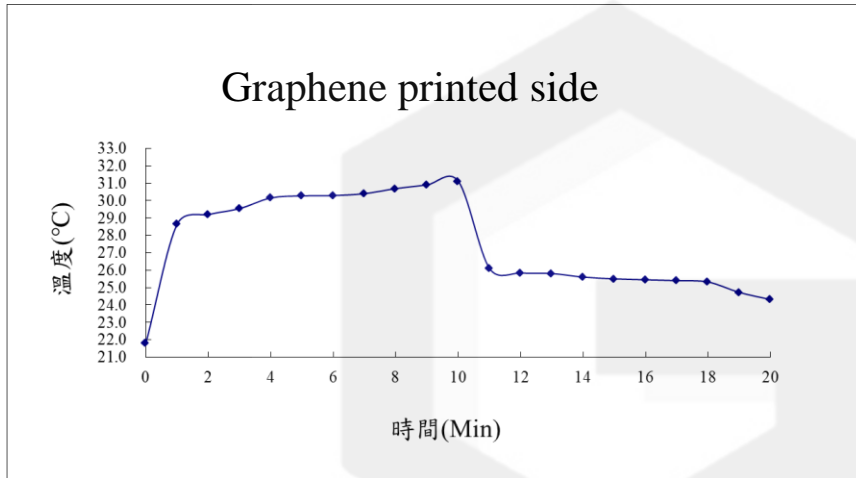
	Control Fbric	Graphene Printed	Pure Fabric
T10 (30.3°C)	0.092	<b>0.160</b>	0.118
T20 (40.3°C)	0.194	<b>0.339</b>	0.249

\* Q-max: W/cm<sup>2</sup>

- As graphene is continuously printed onto the textile, the cooling effect is increased measured by Qmax. With graphene printing process, the cooling effect is not limited by process of spinning. It means that each fabric with each knitted type can increase cooling effect by graphene printed process.

# FLIR test

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$t_0$	$t_{10}$	$t_{20}$
21.8°C	<b>31.1°C</b>	24.3°C

$t_0$	$t_{10}$	$t_{20}$
21.8°C	28.1°C	23.6°C

- As the graphene continuously printed fabric is irradiated by 500W halogen lamp for 10 min, the temperature of the fabric is increased fasted and higher than pure fabric. The temperature of graphene printed fabric after the halogen lamp is off is also higher than pure fabric which means graphene printed fabric also possess function of keeping warm.

# Skin Model Test

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Time(min)	Graphene printed fabric	After wash 50 times	Pure fabric
$t_0$	28.4°C	28.3°C	28.8°C
$t_2$	29.5°C	29.4°C	29.6°C
$t_4$	29.9°C	29.6°C	29.8°C
$t_6$	30.1°C	29.7°C	29.8°C
$t_8$	30.1°C	29.8°C	29.9°C
$t_{10}$	30.2°C	29.9°C	29.9°C
$t_{10}-t_0$	<b>1.8</b>	1.6	1.1

- As the graphene continuously printed fabric is contacted on the ceramic hot plate at 35°C for 10 min, it shows higher temperature than pure fabric. Even after 50 times of wash, the heat effect keeps similar with original graphene printed fabric. It also proves the warming effect of graphene printed layer.

# ASTM D7984 Test

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Test Item		Results	Difference
Thermal effusivity $W \cdot s^{(1/2)} / m \cdot k$	$10 \pm 1^\circ C$	113.0	<b>13.6%</b>
	$30 \pm 1^\circ C$	130.9	
Thermal conductivity $W / m \cdot k$	$10 \pm 1^\circ C$	0.0488	<b>8.9%</b>
	$30 \pm 1^\circ C$	0.0535	

- As the graphene continuously printed fabric is tested by the method of ASTM D7984-2016, the difference of the thermal conductivity between high and low temperature is more than 8%. It shows that the thermal conductive effect is higher as the temperature increased and the heat can be homogenously distributed from human body to maintain the body temperature.

	Standard fabric	Graphene printed fabric
Temp. (°C)	46.9	<b>53.1</b>

\* Irradiated by NIR Lamp for 10 min

- As the graphene continuously printed fabric is tested by the method of TN-037 which is a standard method measuring temperature rise of fabric, the temperature of graphene printed fabric is higher than 6.2 °C after irradiated by a NIR lamp for 10 min. These also proves that graphene printed fabric shows good warm effect for users.

## Conclusion

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- With excellent thermal ability of graphene, graphene can be printed onto fabric and shows excellent properties and it no longer depends on spinning process.
- Graphene can also release far infrared and it has been tested that the effusivity is 0.9.

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