

# Graphene Rubber Test<sup>®</sup>

Enerage Inc.



## Test Condition

Test: Heat Dissipation Effect of Graphene

Contained Rubber

Test Environment: 22.8°C, 62%RH

Test Object: Blank Rubber and 2phr Graphene

Contained Rubber

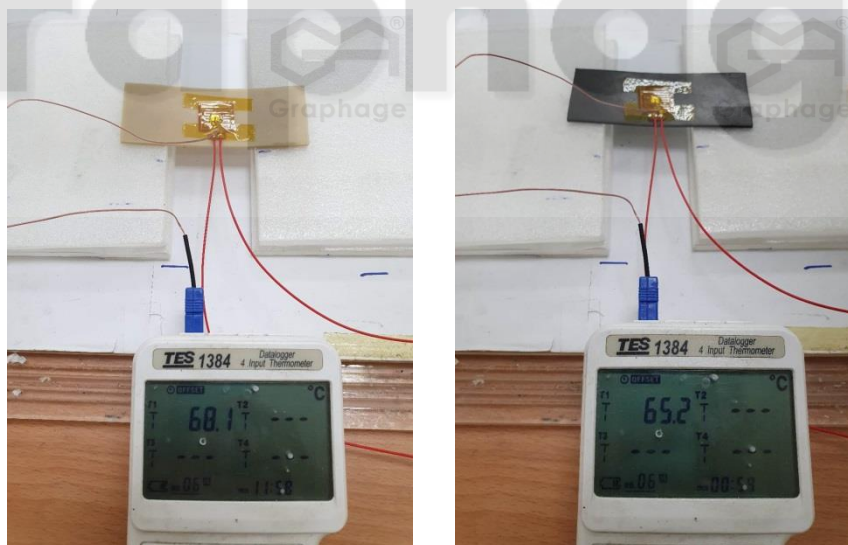
Composition of Rubber:

- Natural Rubber (NR),
- Butadiene Rubber (BR),
- Styrene Butadiene Rubber (SBR)



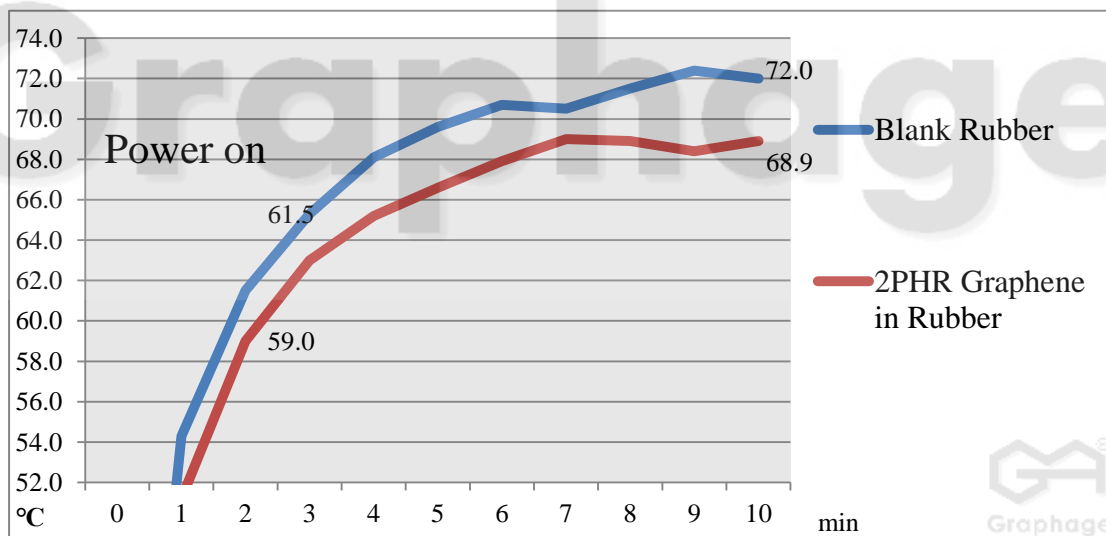
## Test Method

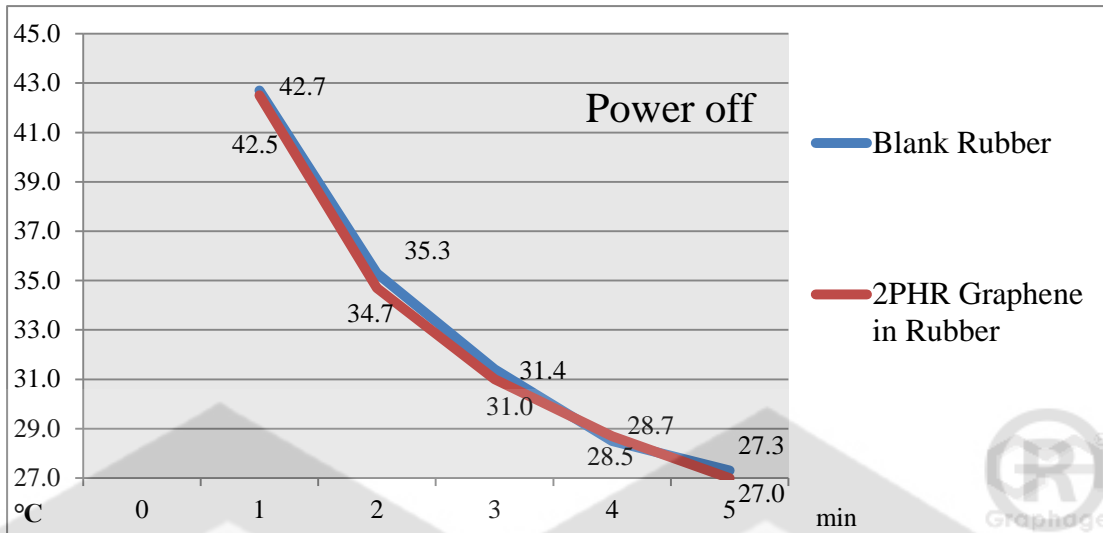
Rectangular thin layer heaters are mounted and fastened by PI tape on rubber pads. 2V voltage and 0.365A current is applied for on the heaters. The power is switched on for 10 minutes and off for 5 minutes. Temperature is recorded every minute.



## Test Result

Time (minute)	Blank Rubber	2PHR Graphene Contained Rubber	Temperature Difference (°C)	Heat Dissipation Efficiency
0	23.7	23.7	0	0.00%
1	54.3	51.2	-3.1	5.71%
2	61.5	59.0	-2.5	4.07%
3	65.3	63.0	-2.3	3.52%
4	68.1	65.2	-2.9	4.25%
5	69.6	66.6	-3.0	4.31%
6	70.7	67.9	-2.8	3.96%
7	70.5	69.0	-1.5	2.13%
8	71.5	68.9	-2.6	3.64%
9	72.4	68.4	-4.0	5.52%
10	72.0	68.9	-3.1	4.31%
Power Off				
1	42.7	42.5	-0.2	0.47%
2	35.3	34.7	-0.6	1.70%
3	31.4	31.0	-0.4	1.27%
4	28.5	28.7	+0.2	-0.70%
5	27.3	27.0	-0.3	1.10%





Rubber containing 2phr graphene begins heat dissipating at the first minute and stably lowers 2~4°C than the blank one after 5 minutes. The dissipation ability stays regardless of the heating during. However the observed temperatures of blank rubber and graphene contained rubber do not have significant temperature difference while the heating power is off. Therefore, it is deducted that rubber is benefited from graphene on heat dissipation and avoiding severely thermal damage under unceasing thermal energy input; i.e. 2phr graphene in rubber contributes 5% improvement of passive heat dissipation ability.

# Graphage

Test: Mechanic Strength of Graphene Rubber

Test Object: Blank Rubber and 0.5phr Graphene Contained Rubber

Composition of Rubber:

- Natural Rubber (NR),
- Butadiene Rubber (BR),
- Styrene Butadiene Rubber (SBR)

Test	Test Standard
Testing Of Rubber And Elastomers- Determination Of Abrasion	DIN53516-1987
Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers- Elongation	ASTM D412
Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers	ASTM D624

