



US009460828B2

(12) **United States Patent**  
**Wu et al.**

(10) **Patent No.:** **US 9,460,828 B2**  
(45) **Date of Patent:** **Oct. 4, 2016**

(54) **GRAPHENE PRINTED PATTERN CIRCUIT STRUCTURE**

(71) Applicant: **Enerage Inc.**, Yilan County (TW)  
(72) Inventors: **Mark Y Wu**, Yilan County (TW);  
**Cheng-Yu Hsieh**, Yilan County (TW);  
**Jing-Ru Chen**, Yilan County (TW);  
**Shu-Ling Hsieh**, Yilan County (TW);  
**Kuan-Ting Li**, Yilan County (TW)

(73) Assignee: **ENERAGE INC.**, Wujie Township,  
Yilan County (TW)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/528,936**

(22) Filed: **Oct. 30, 2014**

(65) **Prior Publication Data**

US 2016/0012936 A1 Jan. 14, 2016

(30) **Foreign Application Priority Data**

Jul. 14, 2014 (TW) ..... 103124112 A

(51) **Int. Cl.**  
**H01B 1/24** (2006.01)  
**H05K 1/09** (2006.01)  
**H05K 1/03** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **H01B 1/24** (2013.01); **H05K 1/0313**  
(2013.01); **H05K 1/097** (2013.01)

(58) **Field of Classification Search**  
CPC ..... C09D 11/52  
See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

2010/0000441 A1 \* 1/2010 Jang ..... C09D 11/037  
106/31.13  
2011/0042813 A1 \* 2/2011 Crain ..... C09C 1/46  
257/746

**FOREIGN PATENT DOCUMENTS**

CN 103319954 A 9/2013  
CN 103468057 A 12/2013  
WO 2014/070500 A1 5/2014

\* cited by examiner

*Primary Examiner* — Ian Rummel

(74) *Attorney, Agent, or Firm* — Muncy, Geissler, Olds & Lowe, P.C.

(57) **ABSTRACT**

Disclosed is a graphene printed circuit pattern structure including a substrate excellent in electrical insulation and a graphene printed circuit layer provided on the substrate. The graphene printed circuit layer is electrically conductive and has a circuit pattern like an electrical circuit on the circuit board. The graphene printed circuit layer includes surface-modified nanographene platelets, a carrier resin and a filler. The ratio of the particle size of the filler to the thickness of the surface-modified nanographene platelet is 2-1000, and the surface-modified nanographene platelets are dispersed in the carrier resin. The filler is uniformly placed among the surface-modified nanographene platelets so as to enhance effective contact for the surface-modified nanographene platelets. The graphene printed circuit pattern structure provides excellent electrical properties and heat dissipation to achieve protection by preventing electrical elements from overheat.

**4 Claims, 1 Drawing Sheet**

