



US009309382B2

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

(10) **Patent No.:** **US 9,309,382 B2**

(45) **Date of Patent:** **Apr. 12, 2016**

(54) **GRAPHENE POLYMER COMPOSITE MATERIAL**

(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)

(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.: **14/527,599**

(22) Filed: **Oct. 29, 2014**

(65) **Prior Publication Data**
US 2015/0368439 A1 Dec. 24, 2015

(30) **Foreign Application Priority Data**
Jun. 24, 2014 (TW) 103121767 A

(51) **Int. Cl.**
C08K 9/06 (2006.01)
C08K 3/04 (2006.01)

(52) **U.S. Cl.**
CPC **C08K 9/06** (2013.01); **C08K 3/04** (2013.01)

(58) **Field of Classification Search**
CPC D01D 5/08; H01B 1/12; D01F 1/09;
C08K 9/06; C08K 3/04
USPC 524/210
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2012/0301707 A1 11/2012 Kinloch et al.
2013/0150516 A1* 6/2013 Lettow C08K 3/04
524/495

FOREIGN PATENT DOCUMENTS

CN 102850543 A 1/2013
CN 103194059 A 7/2013
CN 102321379 B 8/2013
WO WO 2009147415 A1 * 12/2009 C08G 59/5033

* cited by examiner

Primary Examiner — Angela C Scott

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

(57) **ABSTRACT**

Disclosed is a graphene polymer composite material, including a matrix resin, a filler and a plurality of nano-scaled graphene sheets. Each nano-scaled graphene sheet has a surface-modified layer formed of a surface modifying agent, which provides hydrophilic and hydrophobic functional groups used to form chemical bonds with the matrix resin and the filler, thereby greatly improving strength of junction cohesion. The filler helps the graphene sheets to contact each other so as to increase overall electrical conductivity and thermal conductivity. Since the graphene sheets are uniformly dispersed in the matrix resin, the composite material of the present invention possesses excellent mechanical property, anti-oxidation, acid-base resistance, high electrical conductivity and thermal conductivity. Therefore, the composite material is suitable for the industries in need of high performance material.

10 Claims, 1 Drawing Sheet