

# Thermal Percolation Behavior in Thermal Conductivity of Polymer Nanocomposite with Lateral Size of Graphene Nanoplatelet

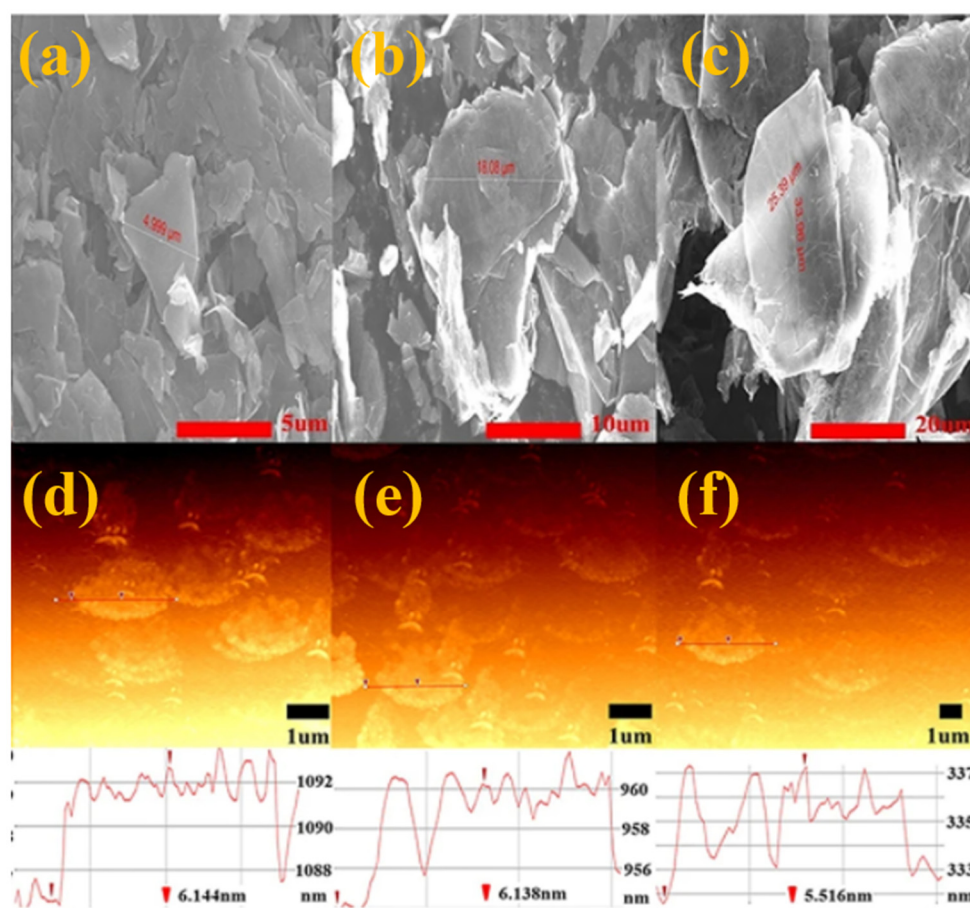
Ji-un Jang <sup>1,†</sup>, Hae Eun Nam <sup>2,†</sup>, Soon Oh So <sup>2</sup>, Hyeseong Lee <sup>2</sup>, Geon Su Kim <sup>2</sup>, Seong Yun Kim <sup>2,\*</sup> and Seong Hun Kim <sup>1,\*</sup>

<sup>1</sup> Department of Organic and Nano Engineering, Hanyang University, 222 Wangsimni-ro, Haengdang-dong, Seongdong-gu, Seoul 04763, Korea; jju204@hanyang.ac.kr (J.-u.J.)

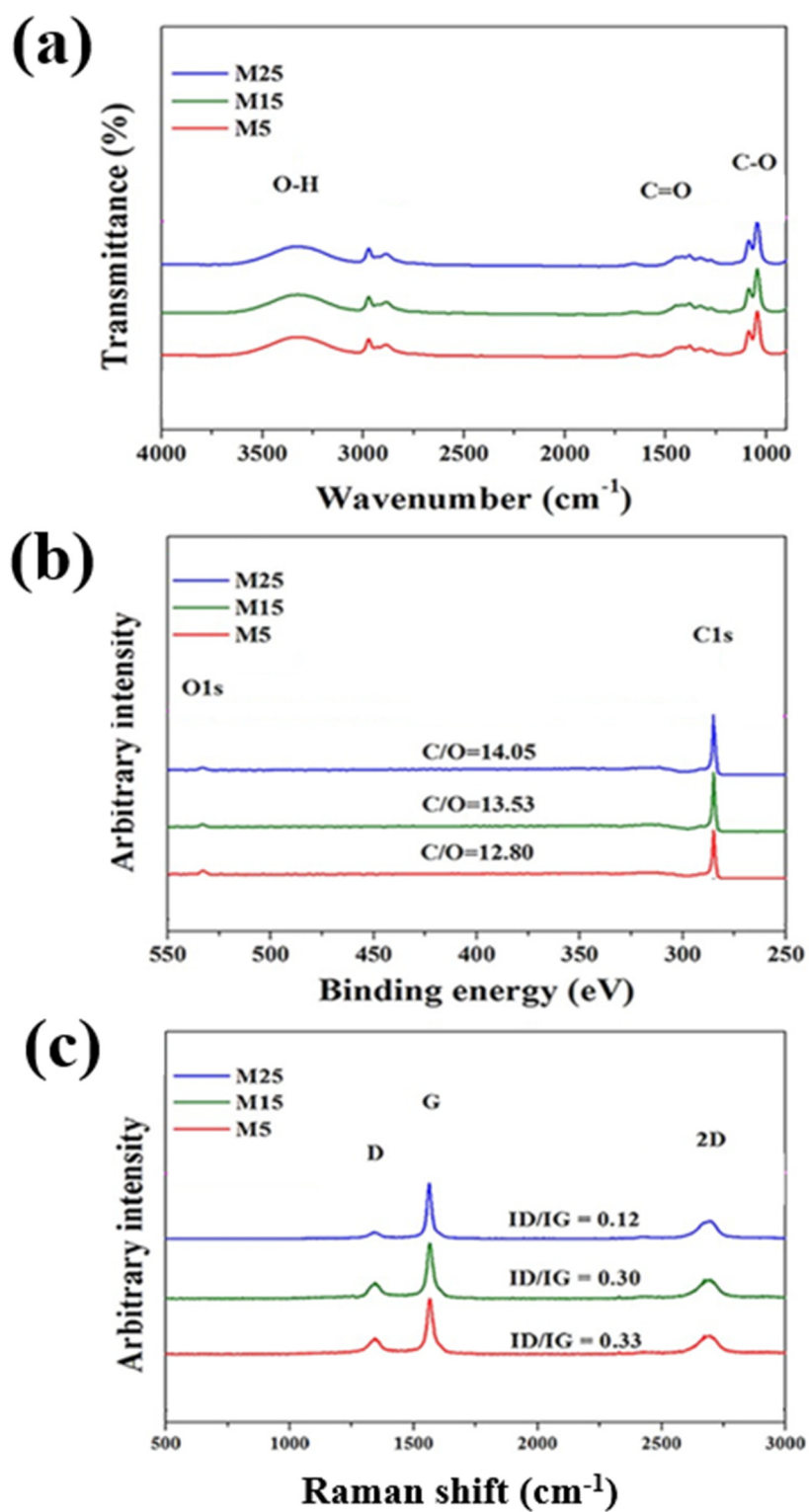
<sup>2</sup> Division of Polymer-Nano & Textile Engineering, Jeonbuk National University, 567 Baekje-daero, Deokjin-gu, Jeonju-si 54896, Jeonbuk, Korea; hae\_eun1912@naver.com (H.E.N.); tnsdh0626@naver.com (S.O.S.); dlgtjd6715@naver.com (H.L.); kuean88@naver.com (G.S.K.)

\* Correspondence: sykim82@jbnu.ac.kr (S.Y.K.); kimsh@hanyang.ac.kr (S.H.K.); Tel.: +82-63-270-2336 (S.Y.K.); +82-2-2281-0496 (S.H.K.)

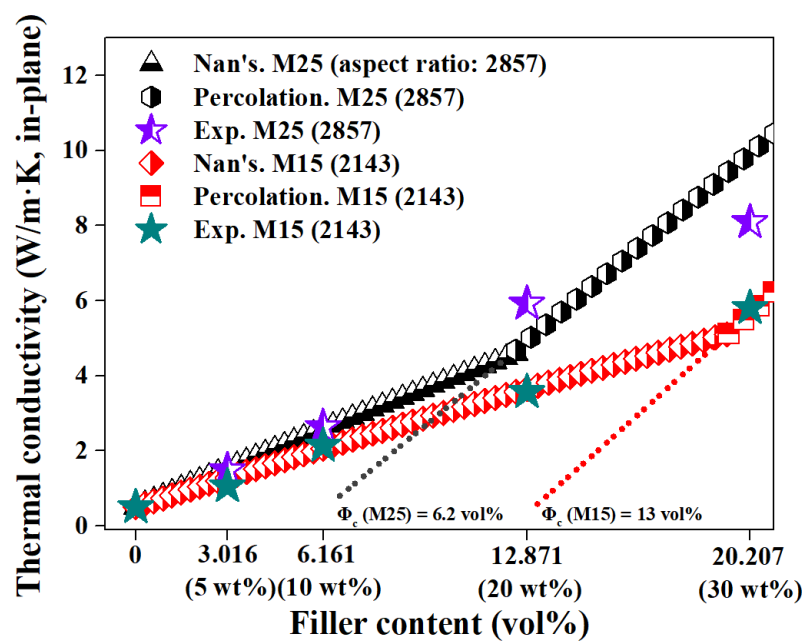
† The first two authors contributed equally.



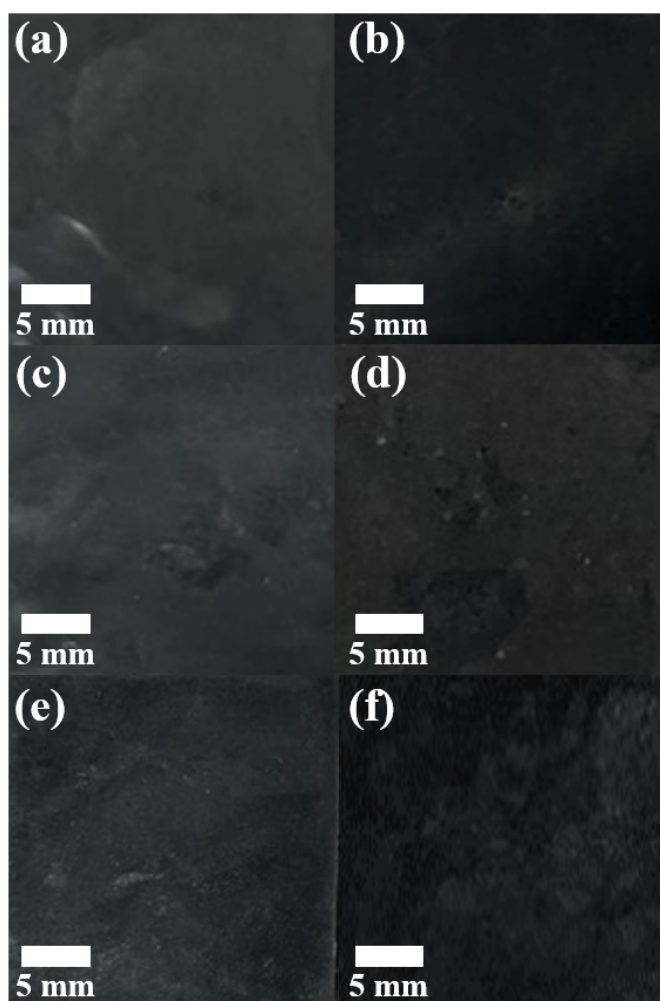
**Figure S1.** FE-SEM images of (a) M5, (b) M15 and (c) M25, and atomic force microscopy results of (d) M5, (e) M15 and (f) M25 (Reproduced with permission [13]. Copyright 2016, Nature Publishing Group).



**Figure S2.** (a) FT-IR, (b) X-ray photoelectron and (c) Raman spectra of GNPs (Reproduced with permission [13]. Copyright 2016, Nature Publishing Group).



**Figure S3.** Thermal conductivity of the fabricated composites considering the critical volume fraction based on the experimental results.



**Figure S4.** Surface photos of the fabricated composites with M5 (a) 10 wt.% and (b) 30 wt.%, and M15 (c) 10 wt.% and (d) 30 wt.%, and M25 (e) 10 wt.% and (f) 30 wt.%.

**Table S1.** In-plane thermal conductivities of composites with GNP fillers.

Filler type	In-plane thermal conductivity (W/m·K)	Enhancement (%)	Loading	Matrix	Ref.
GNP (M25)	8.094	1518.8	30 wt.%	pCBT	This work
GNP (M25)	7.10	857	20 wt.%	pCBT	[25]
GNP (M25)	~ 7	~ 3500	50 wt.%	pCBT	[26]
GNP (M25)	~ 6	~ 2500	20 wt.%	pCBT	[13]
GNP (8 µm)	5.82	2430	30 vol.%	PBT/PC	[27]
GNP (M5)	1.98	1320	20 wt.%	pCBT	[22]
GNP (0.5 µm)	1.09	445	20 wt.%	PP	[28]