Electronic Supplementary Material (ESI) for CrystEngComm.

Supporting Information

Fabrication of core-shelled liquid-metal@silica nanoparticles for enhanced mechanical, dielectric and thermal properties of silicone rubber

Guizhi Zhu,[a,b,‡] Yuliang Tian,[a,b,‡] Junrui Tan,[b,c] Qiong Wu, [b,c] Longfei Tan, [b,c] Xiangling Ren, [b,c] Changhui Fu [b,c] Zhihui Chen,[b] and Xianwei Meng [b,c*]

[a] *School of Materials Science and Engineering, Changzhou University, Changzhou, Jiangsu, 213164, China.*

[b] *Laboratory of Controllable Preparation and Application of Nanomaterials, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, No. 29 East Road Zhongguancun, Beijing, 100190, P. R. China.*

[c] *Key Laboratory of Cryogenics, Technical Institute of Physics and Chemistry, Chinese Academy of Science, Beijing, 100190, PR China*

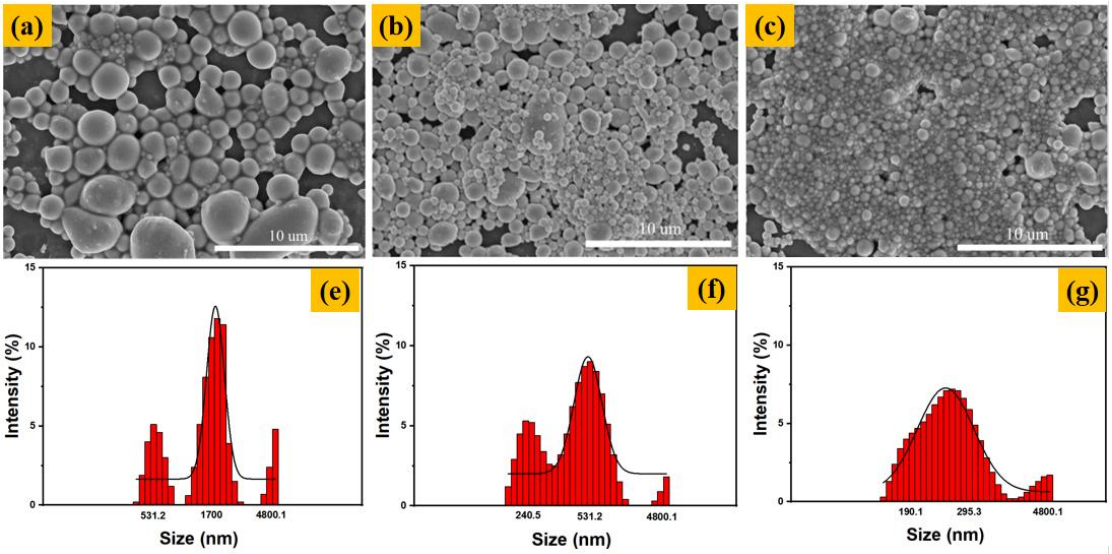

Figure S1. SEM images and particle size distribution of liquid metal nanodroplet:(a) (e)60min; (b) (f) 120 min; (c) (g) 180 min.

Table S1. Compositions of the reaction mixtures

Samples	LM	Ammonia water	Ethanol	TEOS
LM@SiO_2-1	200mg	3ml	60ml	150ul
LM@SiO_2-2	200mg	3ml	60ml	300ul
LM@SiO_2-3	200mg	3ml	60ml	500ul
LM@SiO_2-4	200mg	3ml	60ml	1000ul

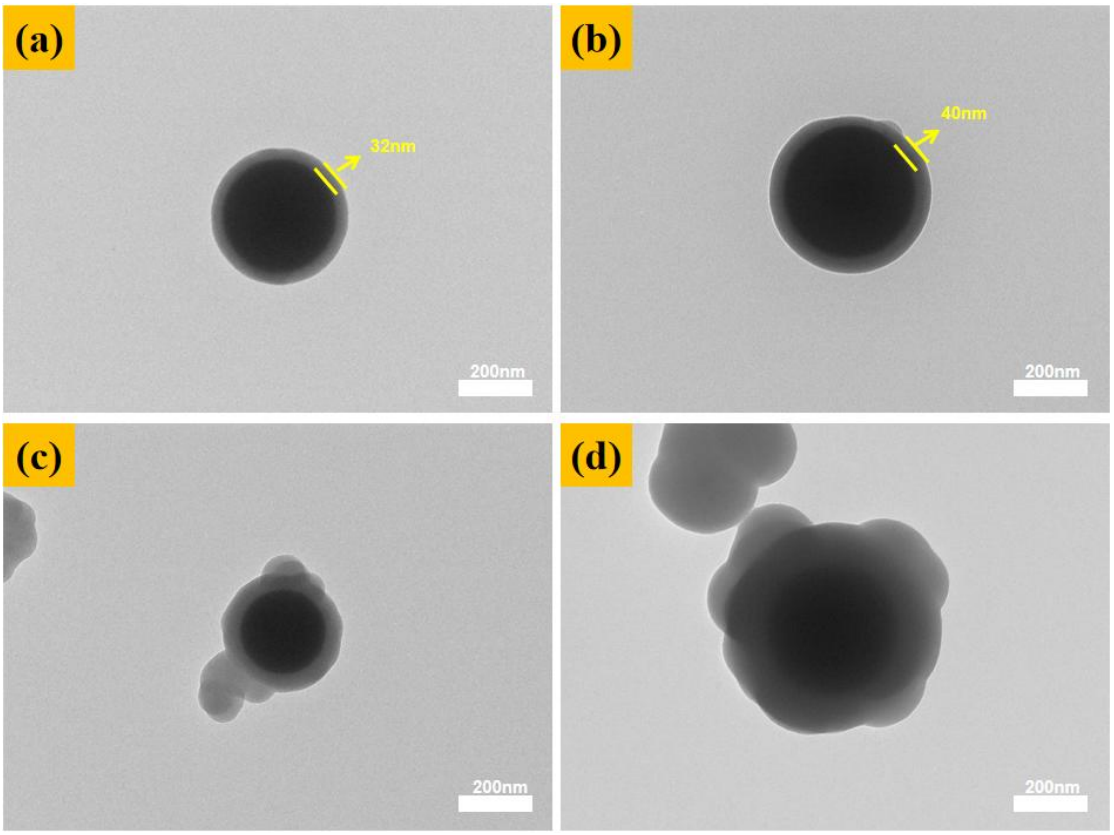

Figure S2. TEM images of LM@SiO_2-NH_2 of different polymer shell thickness: (a)LM@SiO_2-1 (b)LM@SiO_2-2 (c)LM@SiO_2-3 (d) LM@SiO_2-4.

Figure S3. LM@SiO_2-2 and LM@SiO_2-3 dispersion of nanodroplets in ethanol solvent within one week.

Table S2. Components of Silicone Rubbers

Sample	PDMS (g)	LM@SiO_2-NH_2 (g)	LM@SiO_2 (g)	LM (g)	SiO_2 (g)	Total amount of filler (g)
PDMS	1.5	0	/	/	/	0
10 wt.% LM@SiO_2-NH_2/PDMS	1.5	0.167	/	/	/	0.167
20 wt.% LM@SiO_2-NH_2/PDMS	1.5	0.375	/	/	/	0.375
40 wt.% LM@SiO_2-NH_2/PDMS	1.5	1	/	/	/	1
40 wt.% LM@SiO_2/PDMS	1.5	/	1	/	/	1
40 wt.% LM+SiO_2/PDMS	1.5	/	/	0.333	0.667	1

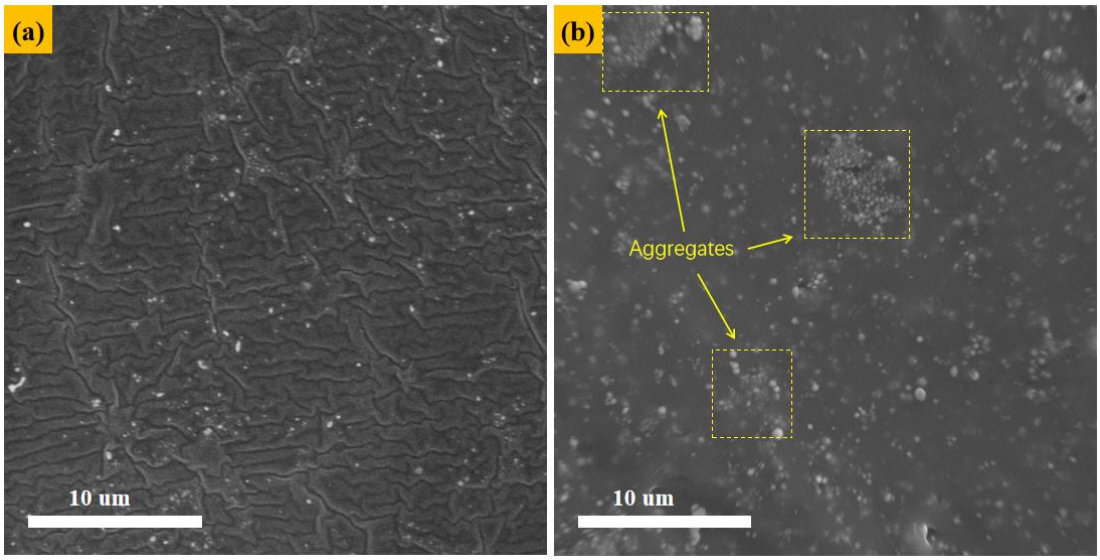

Figure S4. SEM of fracture sections of (a) LM@SiO_2-NH_2/PDMS nanocomposites (b) LM@SiO_2/PDMS nanocomposites.

Table S3. Comparison of dielectric properties between different polymer composites

Composites	Dielectric Constant	Dielectric Loss	Reference
CCTO@PANI/ PDMS	4.2	0.03	31
PVDF/ZnO-APTES	11	0.01	32
PDMS-$PbZr_{0.52}Ti_{0.48}O_3$(PZT)	10.5	0.75	33
Calcium copper titanate(CCTO)/ PDMS	4.18	0.05	34
Coral-like $BaTiO_3$/ PDMS	10.97	1.1	35
LM@SiO_2-NH2/PDMS	**13.9**	**0.006**	**This study**

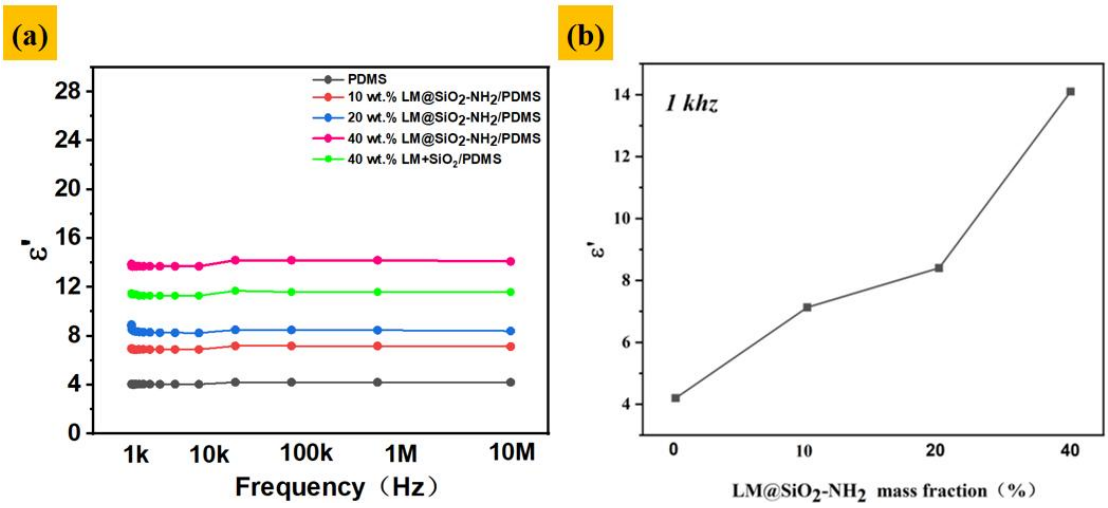

Figure S5. (a) Dielectric properties of LM@SiO_2-NH_2/PDMS and LM+SiO_2/PDMS, (b) dielectric constant of LM@SiO_2-NH_2/PDMS composites under different mass fractions.

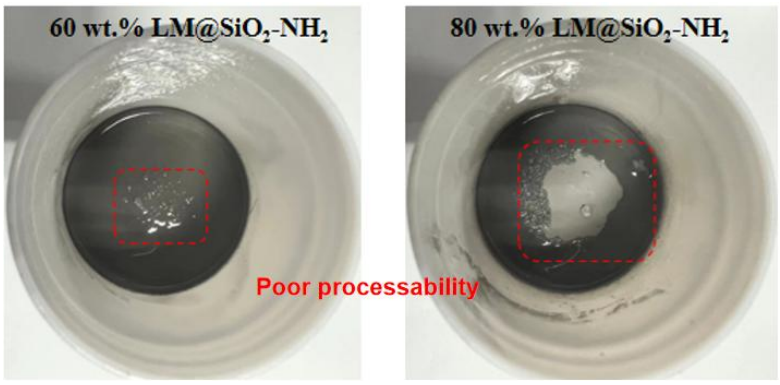

Figure S6. Optical photograph of 60 wt% and 80 wt% of LM@SiO_2-NH_2/PDMS

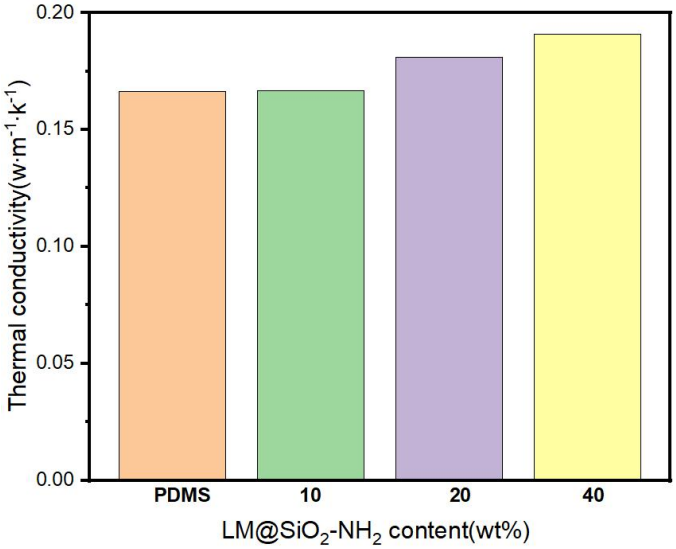

Figure S7. Thermal conductivity of LM@SiO_2-NH_2/PDMS composites under different mass fractions.