ZnO Nanostructured Interphase for Multifunctional and Lightweight Glass Fiber Reinforced Composite Materials Under Various Loading Conditions

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Supporting Information

Table S-1. Property improvement in hierarchical nanofiller/glass fiber reinforced composites.

Integration method	Nanofiller	Specimen	Strain-rate	Mechanical properties	Improvement	Ref.
Electrophoretic deposition	CNTs	Laminate	Quasi-static	In-plane shear	70 %	[1]
Electrophoretic deposition	CNTs	SF	Quasi-static	IFSS (Micro-droplet)	30 %	[2]
Dip-coating	Colloidal silica	SF	Quasi-static	IFSS (Micro-droplet)	38%	[3]
Drawing inside solution	MWCNTs	Laminate	Quasi-static	IFSS (Fiber-pushout)	92%	[4]
Chemical vapor deposition	CNTs	SF	Quasi-static	IFSS (SF segmentation)	7.74%	[5]
Dip-coating	GO/ ANFs	SF	Quasi-static	IFSS (Micro-droplet)	23.6%	[6]
Hydrothermal growth	ZnO	SF	Quasi-static	IFSS (SF Segmentation)	430%	[7]
Resin mixing	SiC/SiO_2	SF	Quasi-static	IFSS (Micro-droplet)	23% / 15.3%	[8]
Resin mixing	ZrO_2	Laminate	Quasi-static	Flexural strength	22 %	[9]
Resin mixing	GO	Laminate	Quasi-static	Flexural strength	21%	[10]
Resin mixing	GnPs	Laminate	Quasi-static	Flexural modulus	26.3%	[11]
Resin mixing	Nanoclay	Laminate	Quasi-static	Flexural modulus	25%	[12]
Spray-coating	CNTs	Laminate	Dynamic	Impact strength	15%	[13]
Resin mixing	Nanoclay	Laminate	Dynamic	Impact energy	5%	[14]
Resin mixing	NH_2-CNTs	Laminate	Dynamic	Impact strength	56%	[15]
Resin mixing	MWCNTs	Laminate	Dynamic	Ballistic limit	6.5 %	[16]
Resin mixing	GnPs	Laminate	Dynamic	Projectile exit velocity	89%	[17]
Hydrothermal growth	ZnO	SF	Static	IFSS (SFP)	96%	This work
Hydrothermal growth	ZnO	SF	Static	IFSS (SFP)	68 %	This work

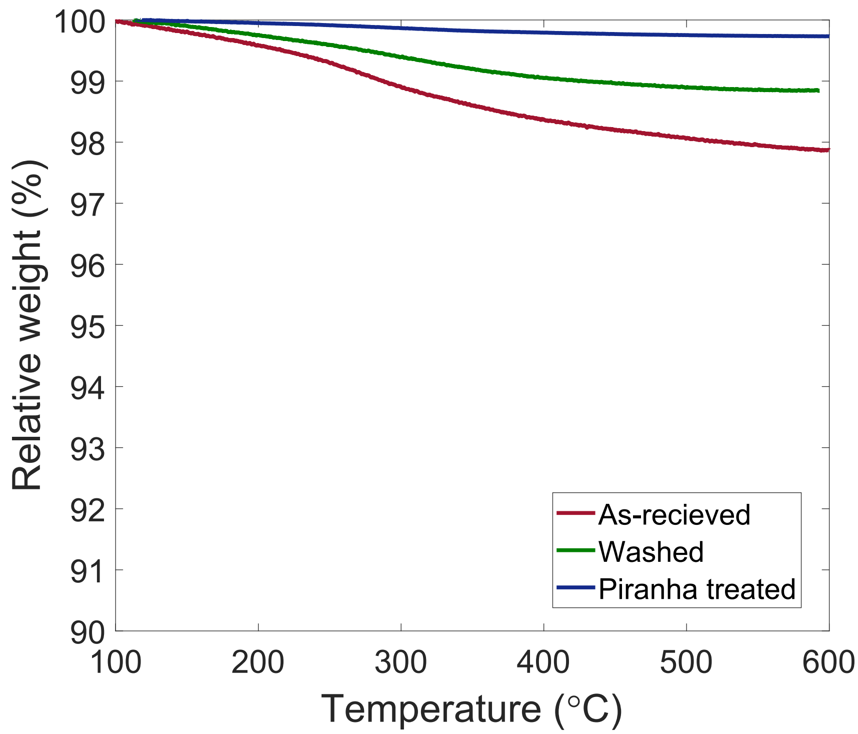

Figure S-1. TGA curve of as-received, washed, and piranha treated glass fibers prior to ZnO coating.

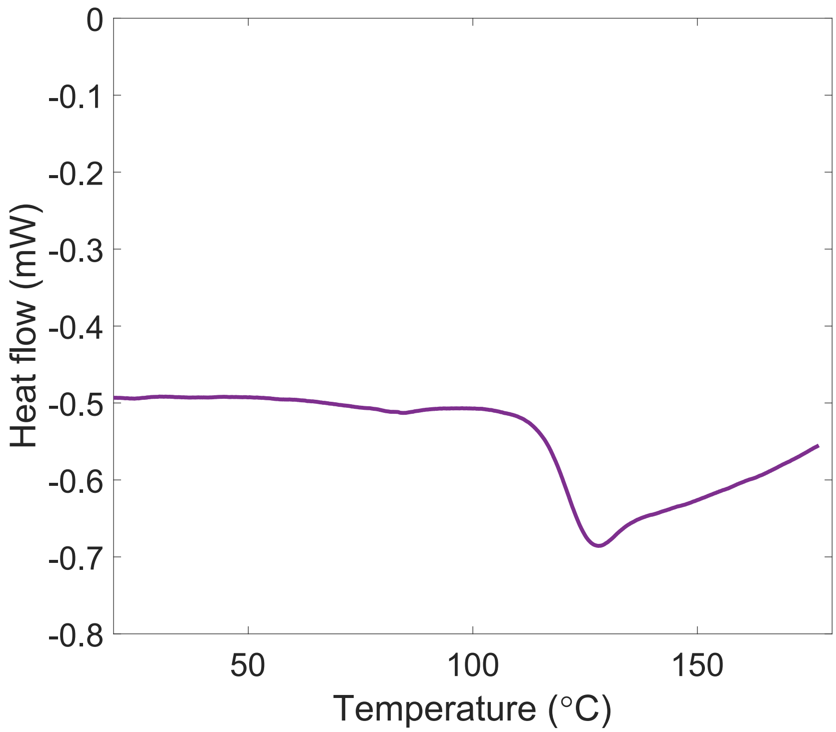

Figure S-2. DSC curve of EPON 862/curing agent W matrix.

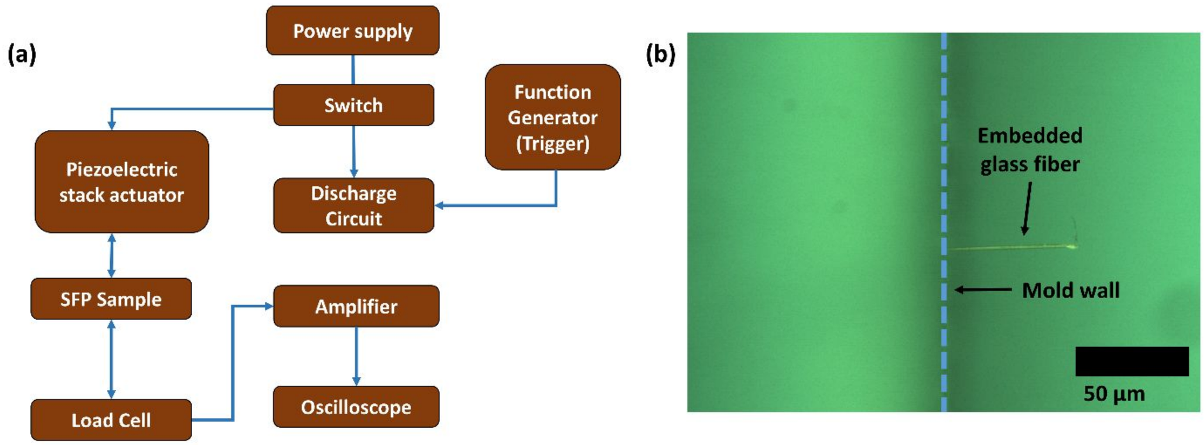

Figure S-3. (a) Schematic of dynamic loading experimental setup. (b) Embedded length control process of glass fiber SFP specimens using optical microscopy.

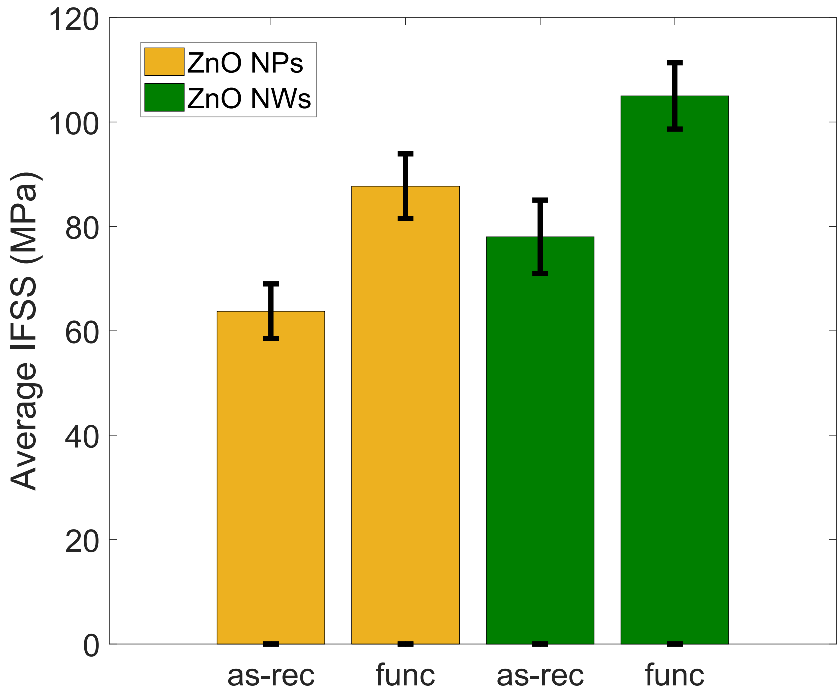

Figure S-4. Interfacial shear strength of as-received (as-rec) and functionalized (func) ZnO nanomaterials coated glass fibers at quasi-static loading rate.

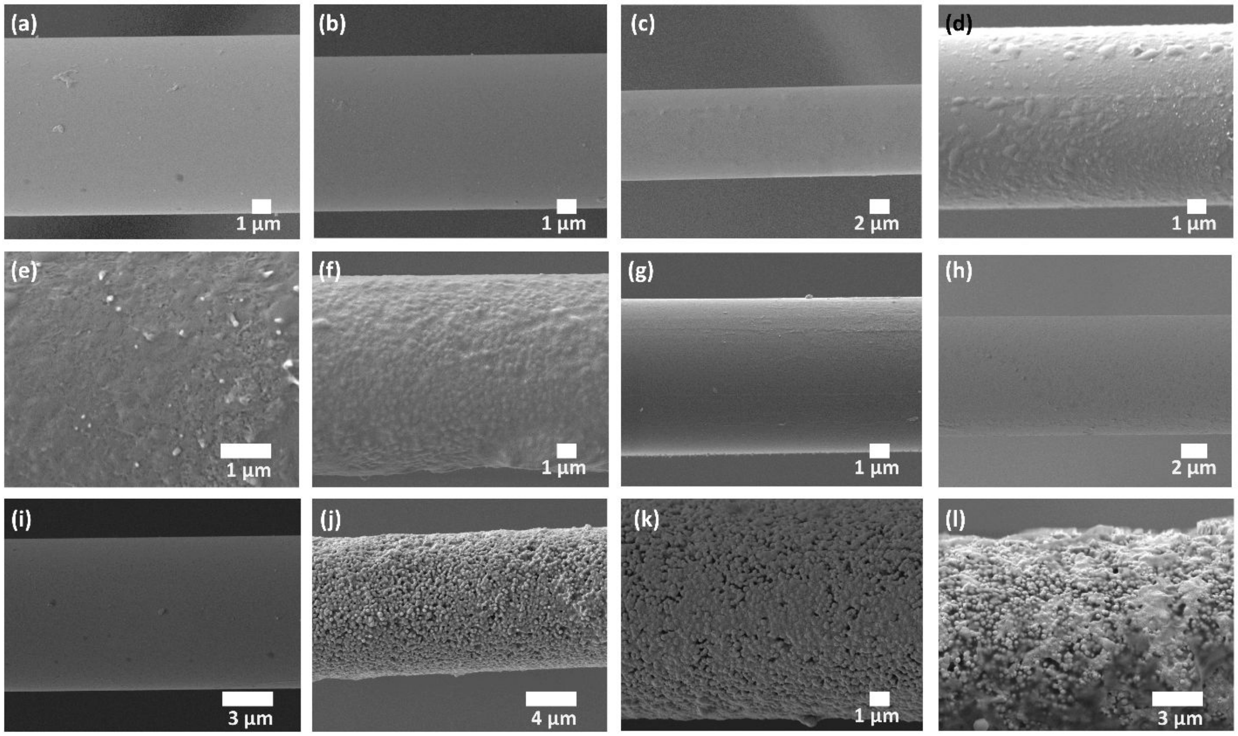

Figure S-5. SEM images of post-pullout embedded length of ZnO nanoparticles coated glass fibers at quasi-static and dynamic strain rates. (a), (b) & (c) 0.0016 s^{-1}. (d), (e) & (f) 2200 s^{-1}. SEM images of post-pullout embedded length of ZnO nanowires coated glass fibers at quasi-static and dynamic strain rates. (g), (h) & (i) 0.0016 s^{-1}. (j), (k) & (l) 2200 s^{-1}.

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