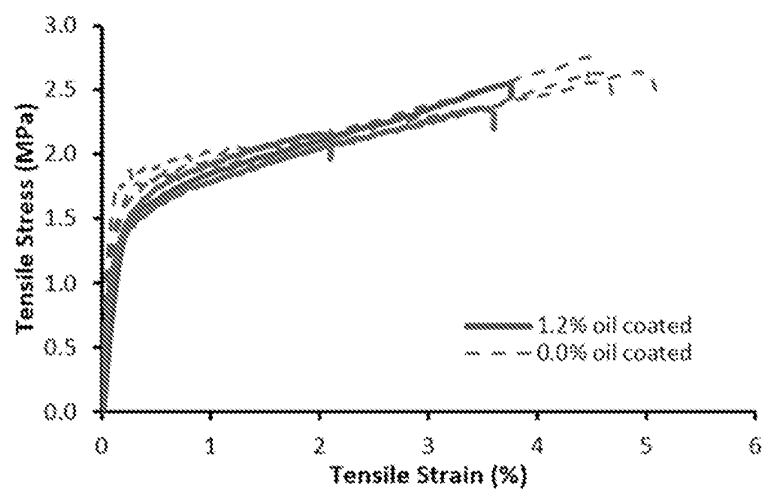


FIG. 1A**FIG. 1B**

Sample	Results of uniaxial tensile test		
	First cracking strength (MPa)	Ultimate tensile strength (MPa)	Tensile strain capacity (%)
0.0% oil coated	1.57 ± 0.14	2.62 ± 0.10	4.73 ± 0.30
1.2% oil coated	1.40 ± 0.07	2.34 ± 0.21	3.14 ± 0.93

FIG. 1C

Sample	Number of cracks	Average crack spacing (mm)
0.0% oil coated	153 ± 27	0.9
1.2% oil coated	97 ± 72	1.3

FIG. 2A

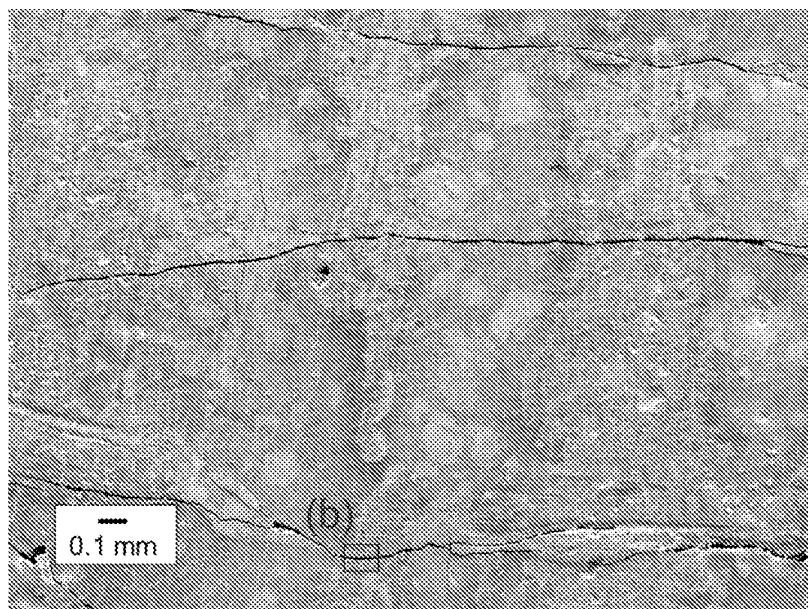


FIG. 2B

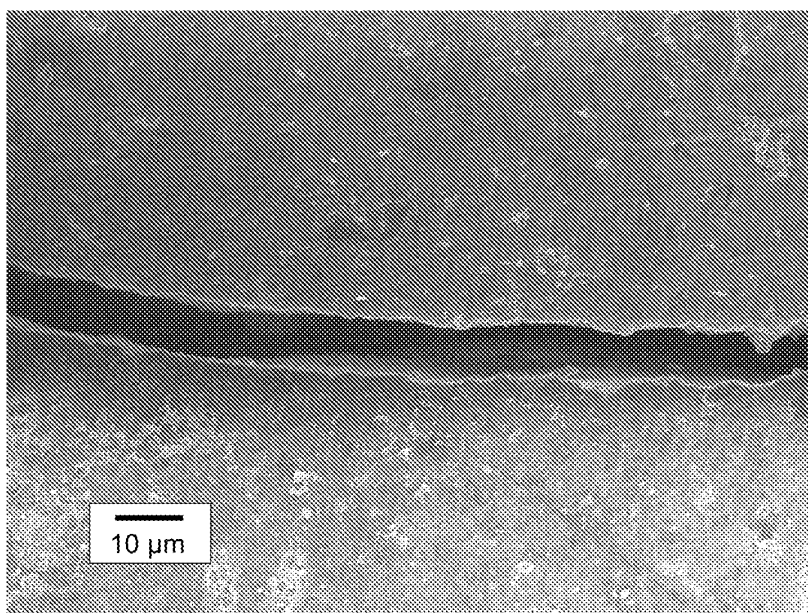


FIG. 3A

Material	MgO	CaO	SiO ₂	Al ₂ O ₃	R ₂ O ₃	K ₂ O	Na ₂ O
MgO	>91.5%	1.6%	2.0%	<0.7%	-	-	-
MS	-	-	>93.0%	-	-	-	-
PC	0.9%	66.2%	20.9%	-	>10.0%	0.5%	0.1%
Fly ash	0.8%	1.2%	58.6%	30.4%	>4.7%	1.5%	-

FIG. 3B

Length (mm)	Diameter (µm)	Fiber aspect ratio (i.e., length/ diameter)	Density (kg/m ³)	Nominal tensile strength (MPa)	Surface oil- content (wt%)
12	59	307	1300	1600	1.2

FIG. 3C

Sample	Dry mix (wt%)				w/b	Superplasticizer (wt% of total binder)	Fiber content (vol%)
	Binder						
	MgO	MS	PC	Sand			
SHRSHC	50	50	-	-	0.45	2.0% - SHMP	2
SHCC MAS	-	-	55.3	26.7	0.24	1.4% - HRWR	2

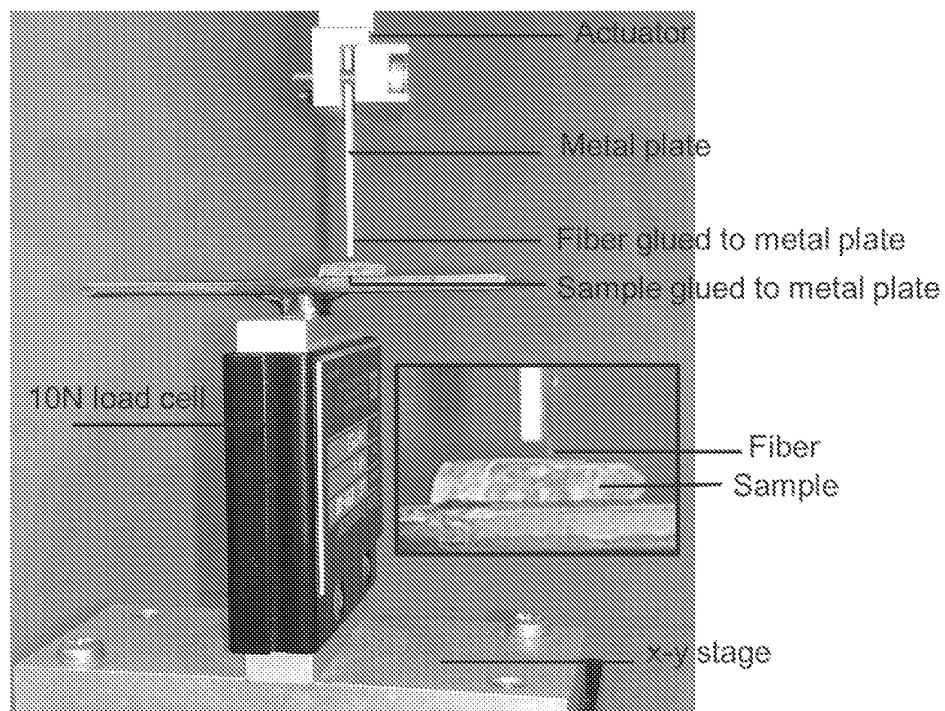
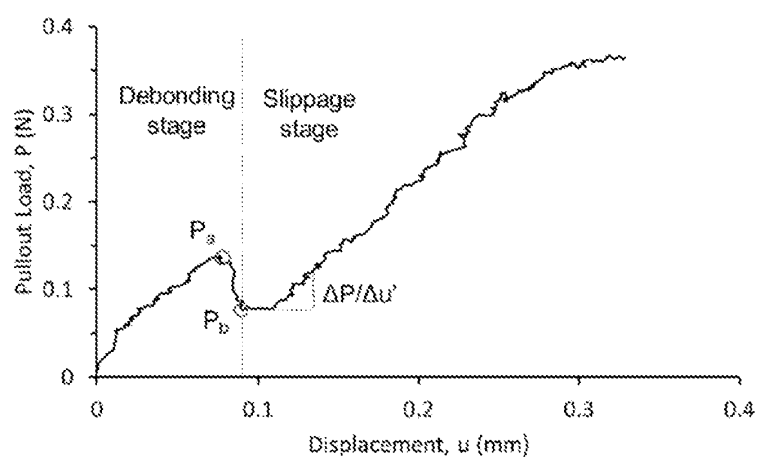
FIG. 4**FIG. 5**

FIG. 6

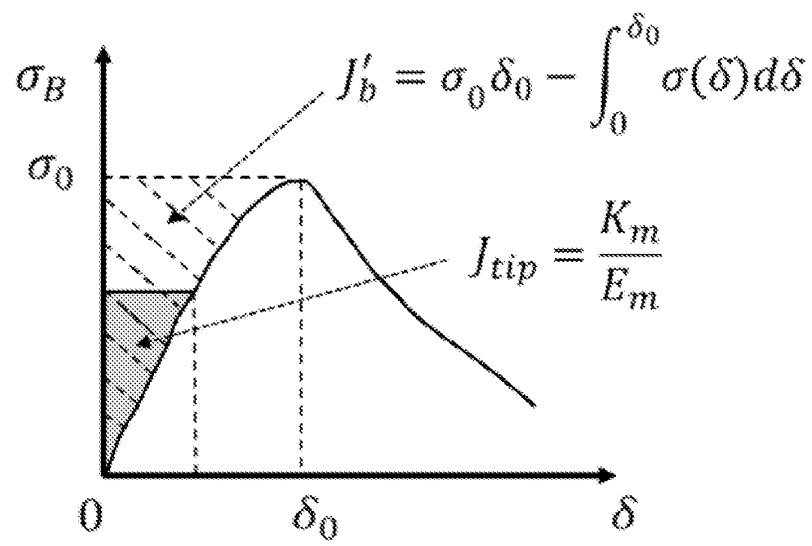


FIG. 7

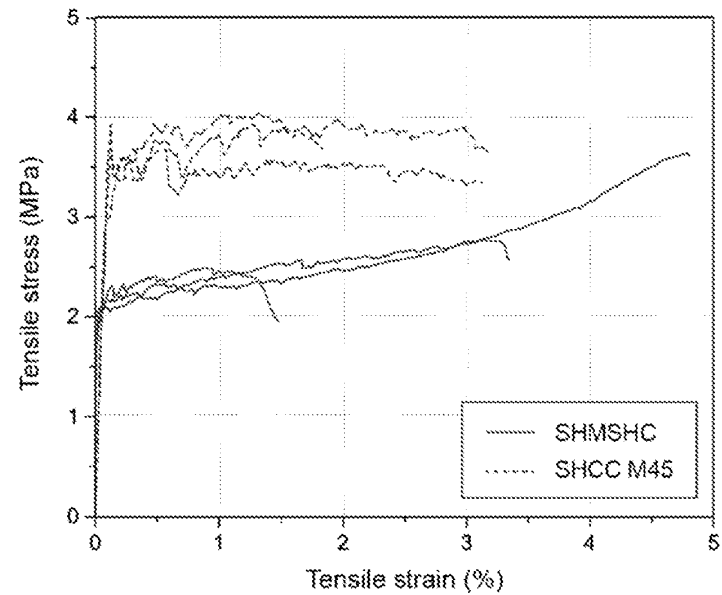


FIG. 8

Sample	Compressive strength (MPa)	Results of uniaxial tensile test		
		First cracking strength (MPa)	Ultimate tensile strength (MPa)	Tensile strain capacity (%)
SHMSHC	54.3 ± 0.5	1.93 ± 0.12	2.93 ± 0.64	3.11 ± 1.76
SHCC M45	53.6 ± 2.7	3.49 ± 0.57	3.72 ± 0.26	2.48 ± 0.73

FIG. 9A

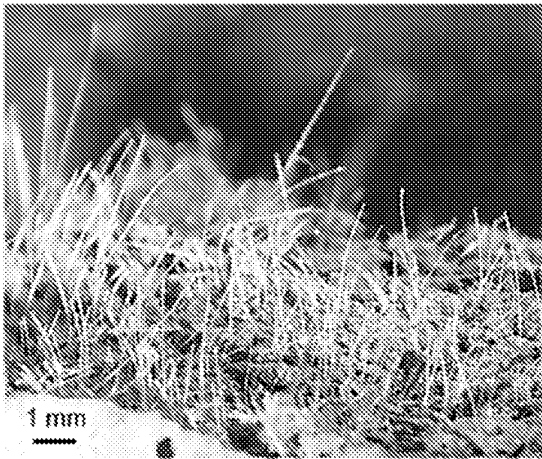


FIG. 9B

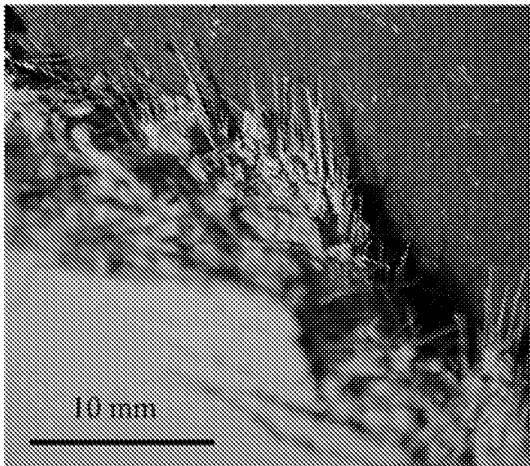


FIG. 10A

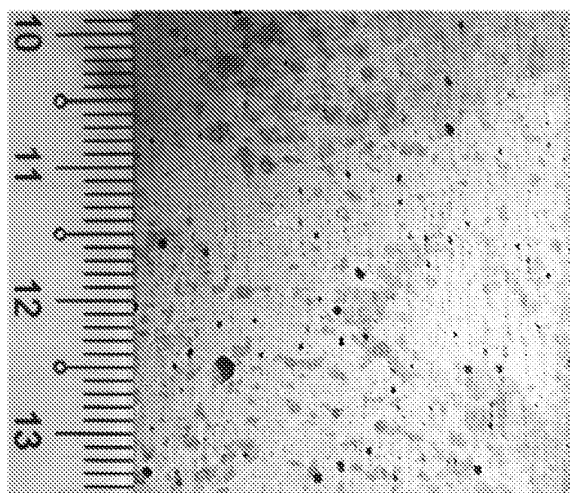


FIG. 10B

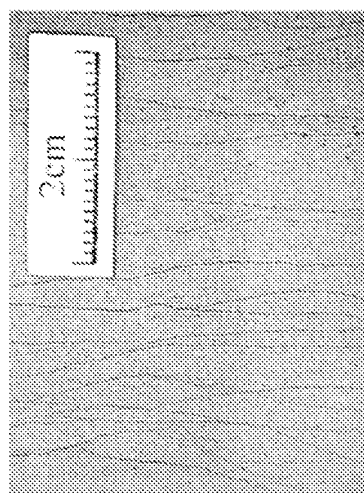


FIG. 11A

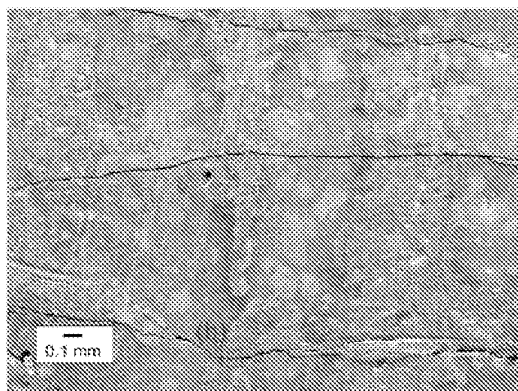


FIG. 11B

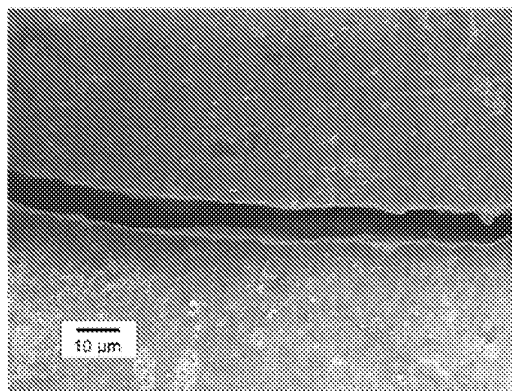


FIG. 12

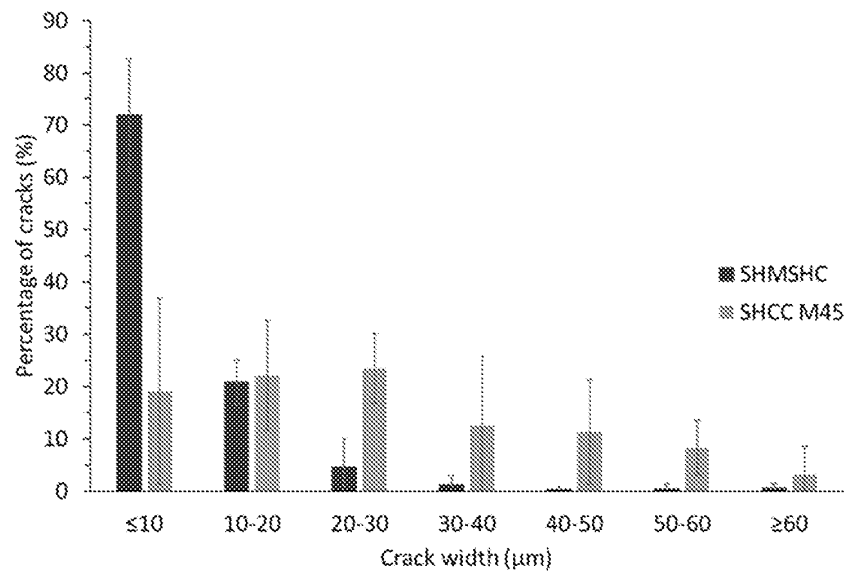


FIG. 13

Sample	Average residual crack width (μm)	Average crack spacing (mm)
SHMSHC	9.7 ± 10.7	1.3
SHCC M45	31.4 ± 17.7	2.5

FIG. 14

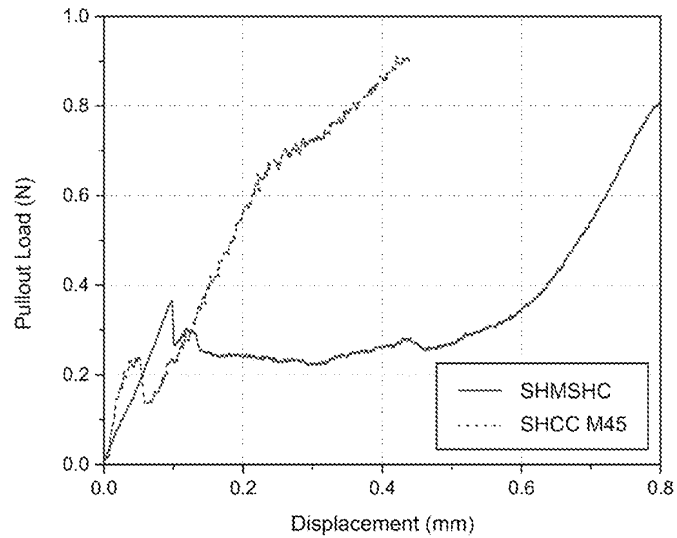
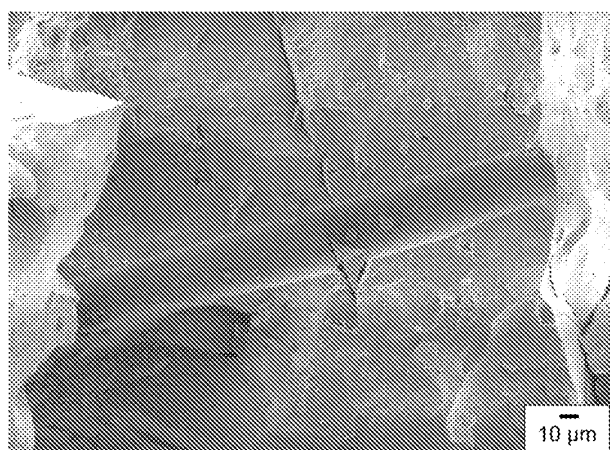


FIG. 15

Matrix type	G_d (J/m ²)	τ_0 (MPa)	β_1	β_2
SHMSHC	0.61 ± 0.26	1.66 ± 0.42	0.03 ± 0.01	0.25 ± 0.07
SHCC M45	1.08 ± 0.80	1.31 ± 0.50	0.58 ± 0.17	—

FIG. 16**FIG. 17**

	Indentation hardness (H, GPa)	Indentation modulus (M, GPa)	Fracture toughness (K_{IC} , MPa- m ^{1/2})	Toughness (J_{tip} , J/ m ²)
SHMSHC matrix	1.04 ± 0.27	21.07 ± 3.76	0.10 ± 0.02	0.45 ± 0.17
SHCC M45 matrix	1.66 ± 0.54	41.65 ± 6.93	0.35 ± 0.04	2.89 ± 0.64

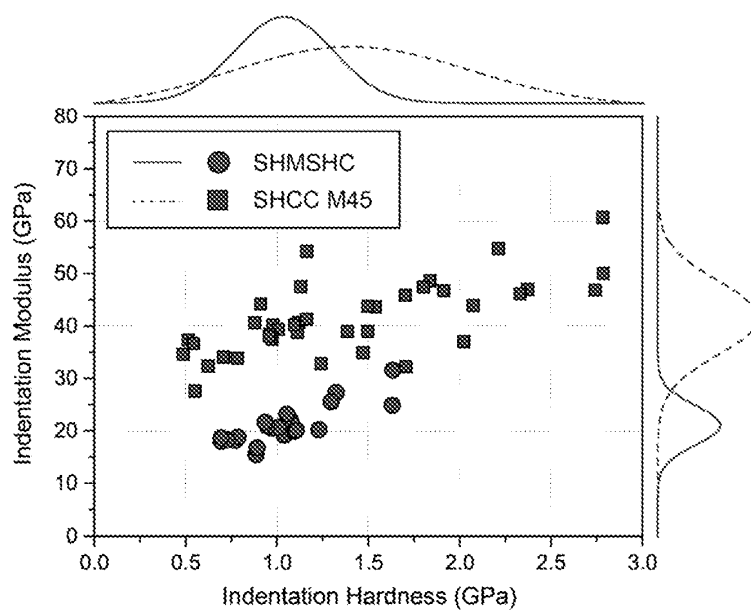
FIG. 18

FIG. 19

Mix	Fiber			Interface				Matrix			
	E_f (GPa)	L_f (mm)	d_f (μ m)	σ_{fb} (MPa)	V_f (%)	f	$\bar{f}$	G_c (J/m ²)	τ_0 (MPa)	β_1	β_2
SHMSHC	25.8	12	39	900	2	0.2°	0.33°	0.61	1.66	0.63	0.25
SHCC M45	25.8	12	39	900	2	0.2°	0.33°	1.08	1.31	0.58	0.58

^a Assumed value.

FIG. 20

	J_b' (J/ m ²)	J_{dp}	σ_0 (MPa)	σ_c (MPa)	PSH_{energy} $=J_b'/J_{dp}$	$PSH_{strength}$ $=\sigma_0/\sigma_c$
SHMSHC	54.4	0.45	4.9	1.93	121	2.54
SHCC M45	88.0	2.89	5.2	3.49	30	1.49

FIG. 21

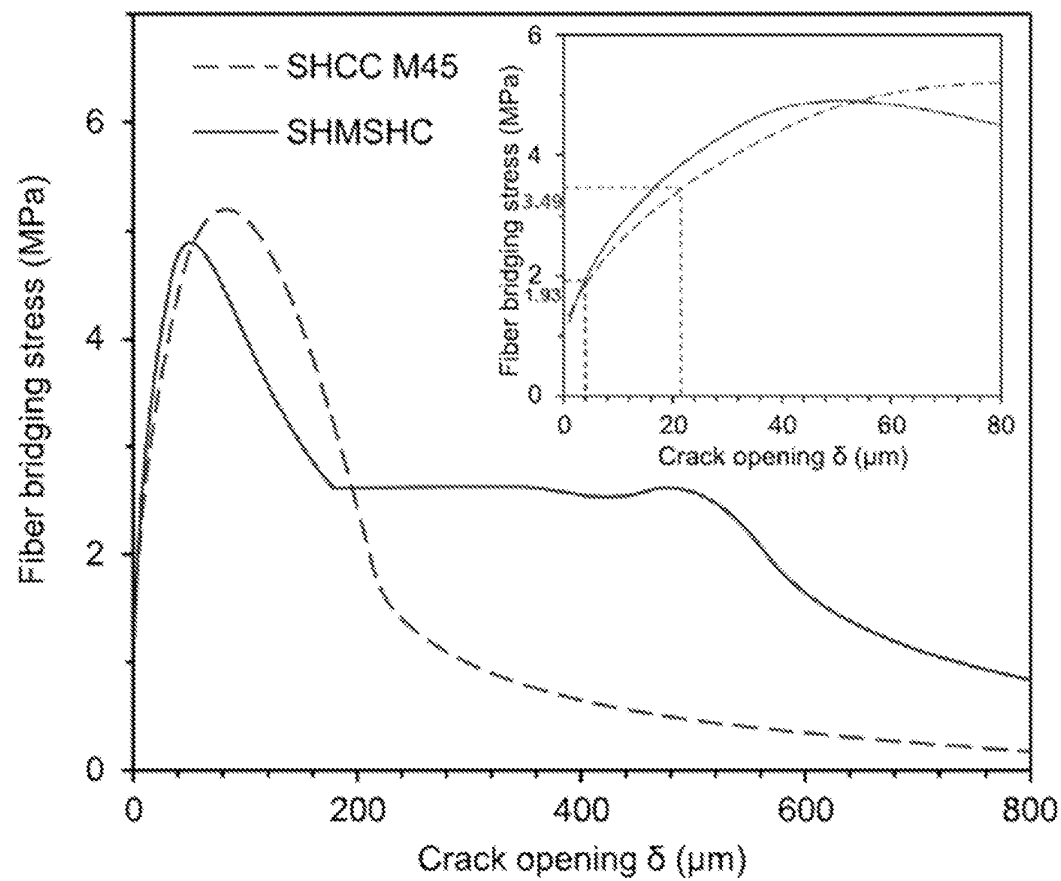


FIG. 22

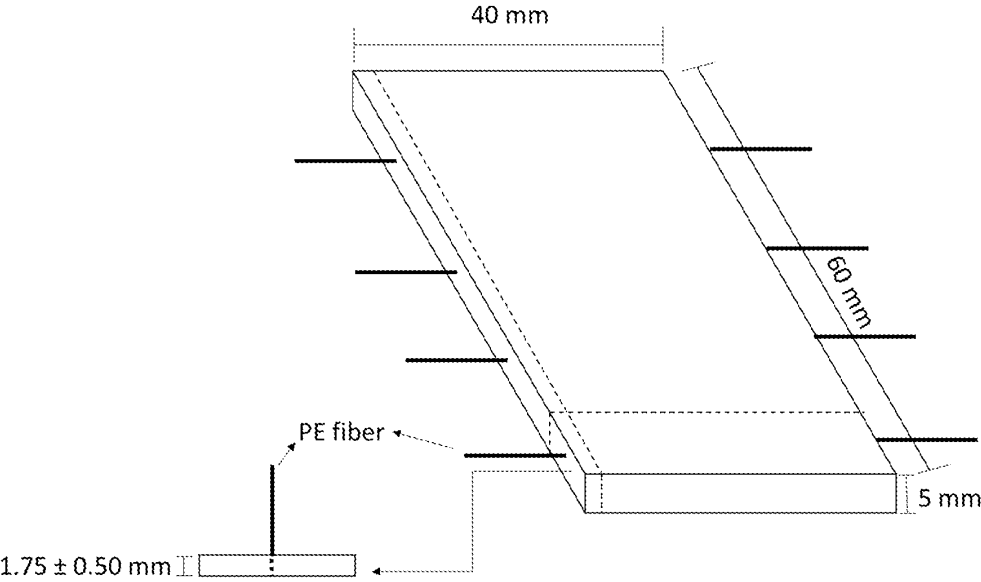


FIG. 23

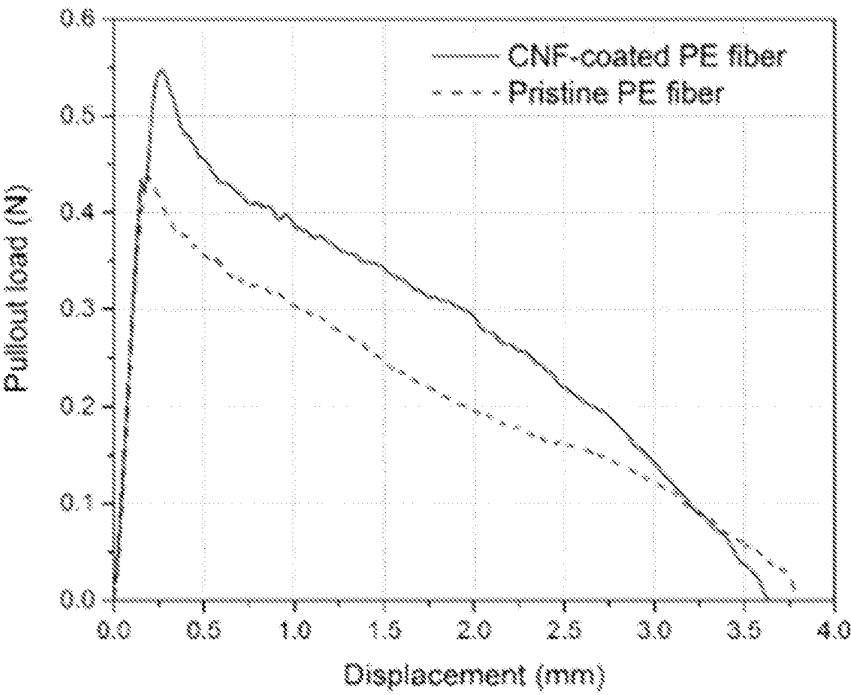


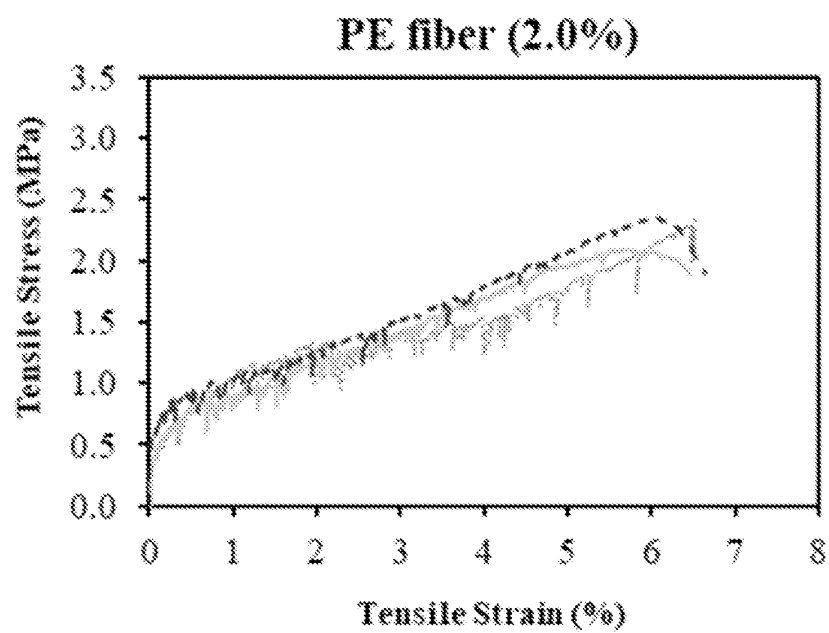
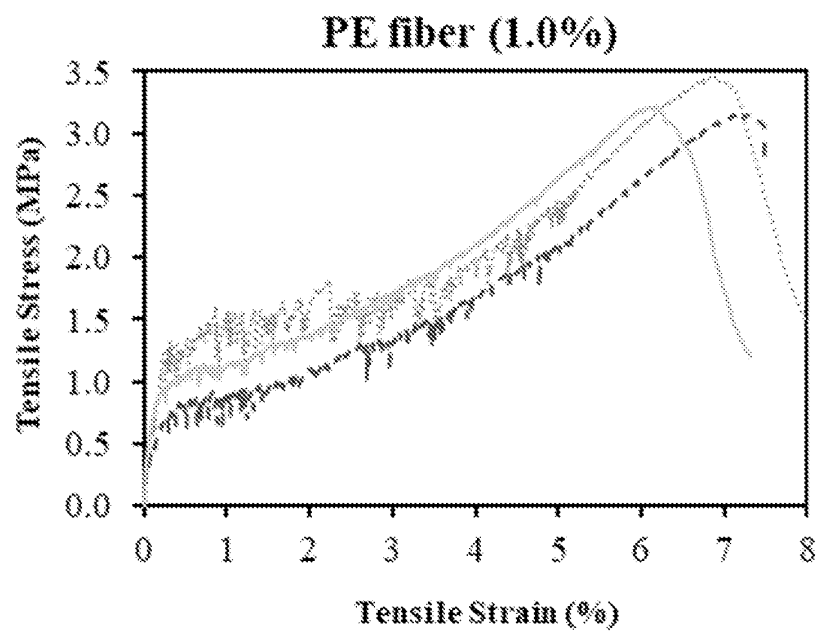
FIG. 24A**FIG. 24B**

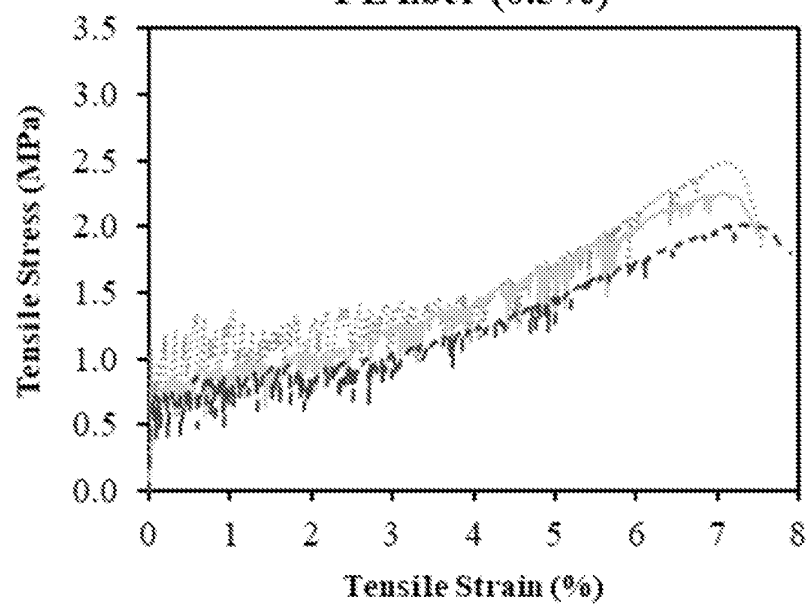
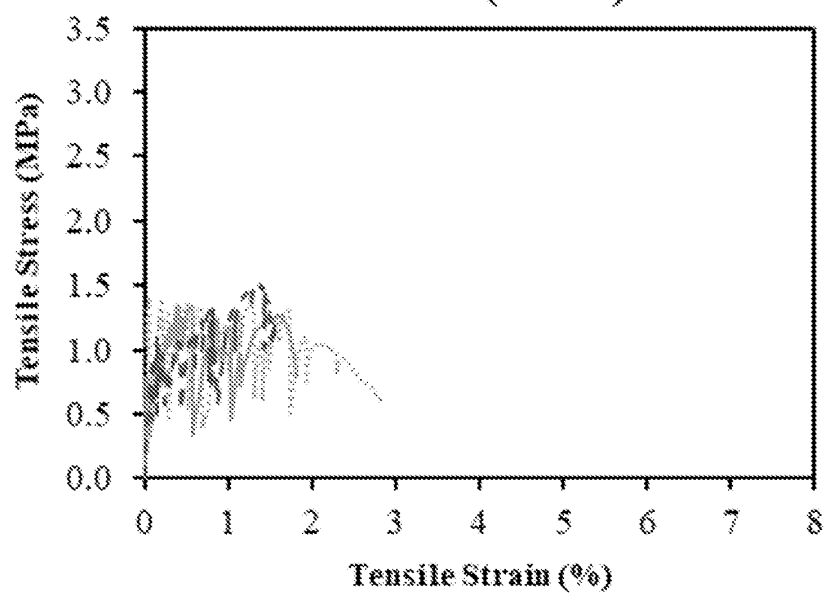
FIG. 24C**PE fiber (0.5%)****FIG. 24D****PE fiber (0.25%)**

FIG. 24E

Fiber dosage (vol.%)	Compressive strength (MPa)	Tensile behavior		
		Initial cracking stress (MPa)	Ultimate tensile stress (MPa)	Tensile strain capacity (%)
2%	69.4 ± 8.2	0.54 ± 0.08	2.25 ± 0.17	6.33 ± 0.28
1%	72.9 ± 3.2	0.51 ± 0.27	3.23 ± 0.20	6.80 ± 0.50
0.5%	86.1 ± 3.1	0.62 ± 0.40	2.24 ± 0.21	7.20 ± 0.13
0.25%	77.7 ± 7.1	0.78 ± 0.43	1.41 ± 0.10	0.84 ± 0.70

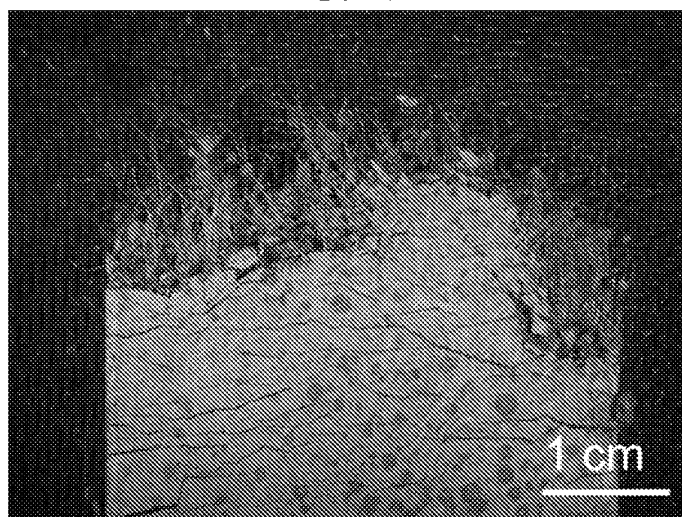
FIG. 25A

FIG. 25B

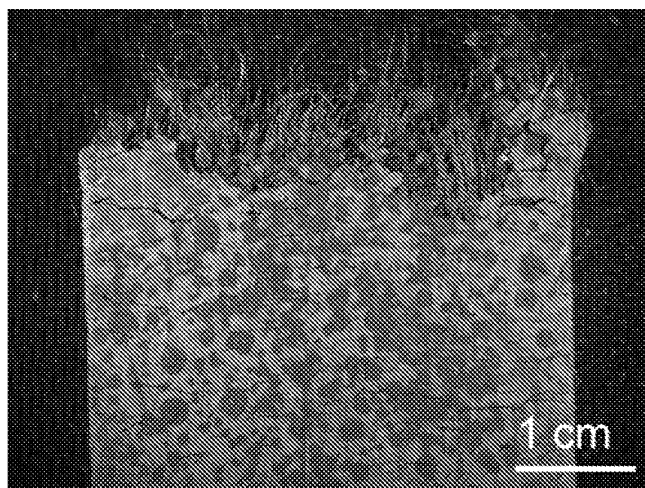


FIG. 25C

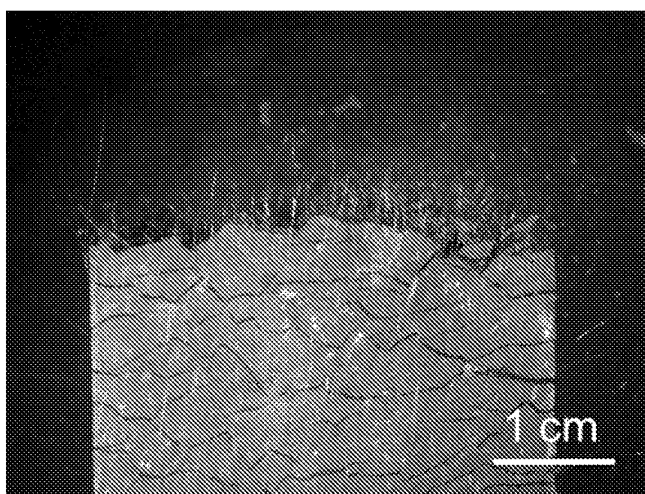


FIG. 25D

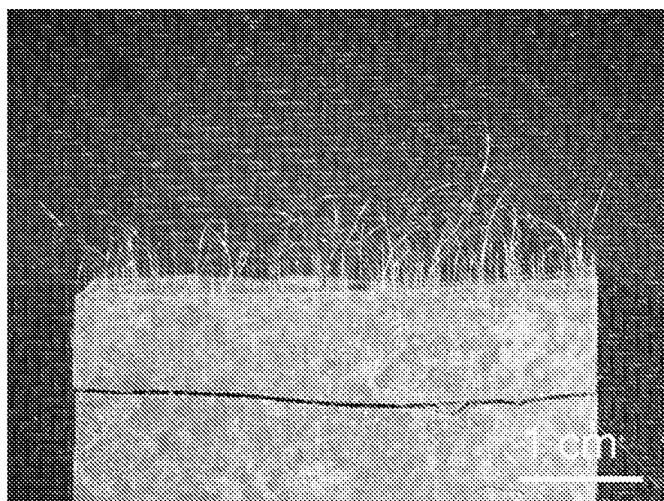


FIG. 26A

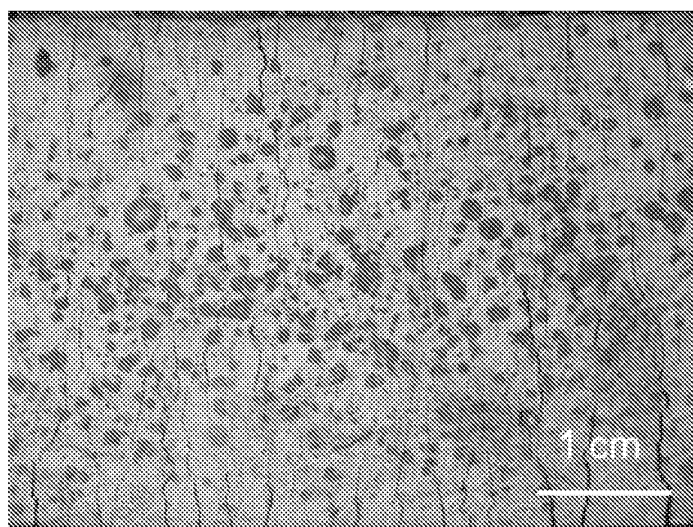


FIG. 26B

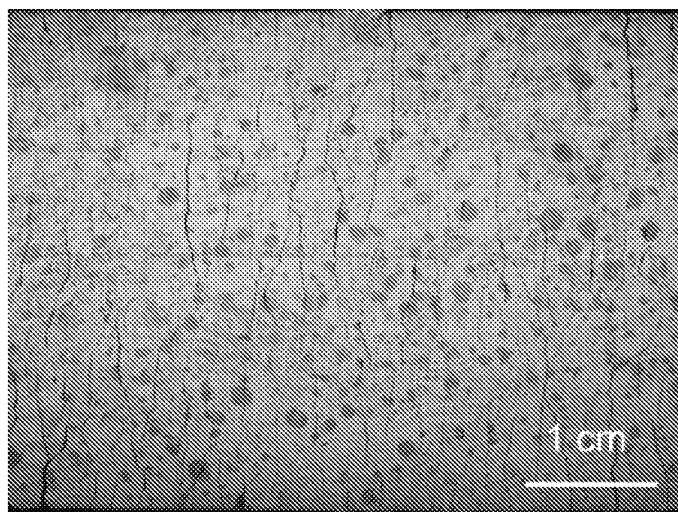


FIG. 26C

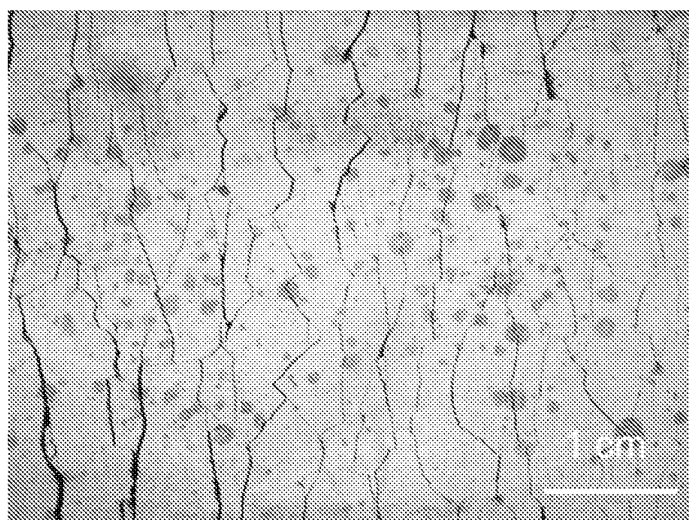
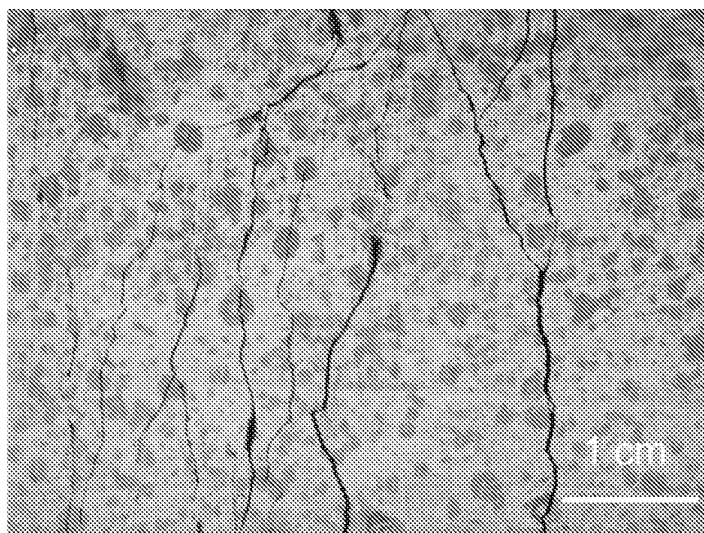


FIG. 26D**FIG. 26E**

Fiber dosage	Average residual crack width (μm)	Average crack spacing (mm)
2%	37.5 ± 38.5	0.94
1%	44.3 ± 32.5	0.92
0.5%	73.5 ± 56.2	1.80
0.25%	54.8 ± 86.4	4.59

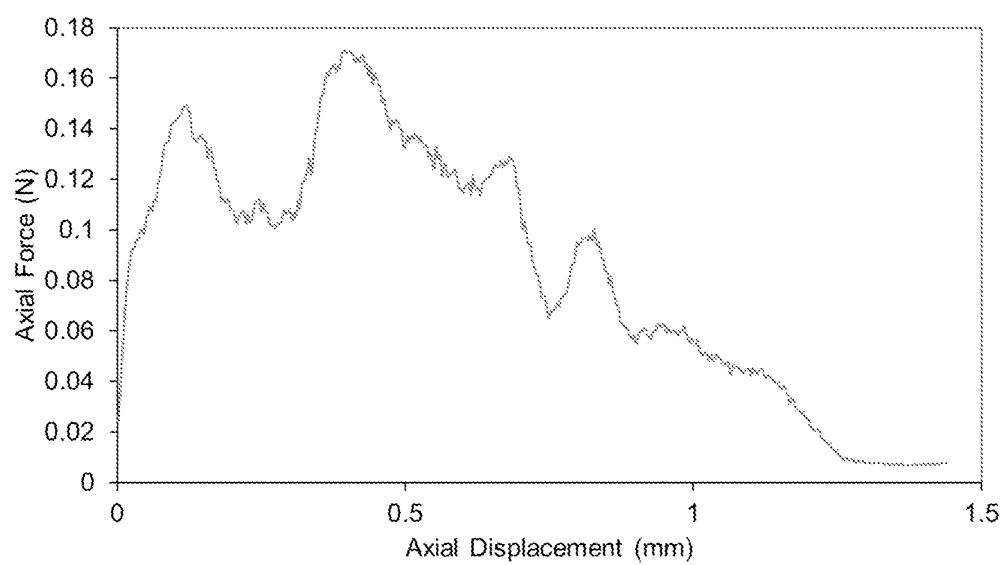
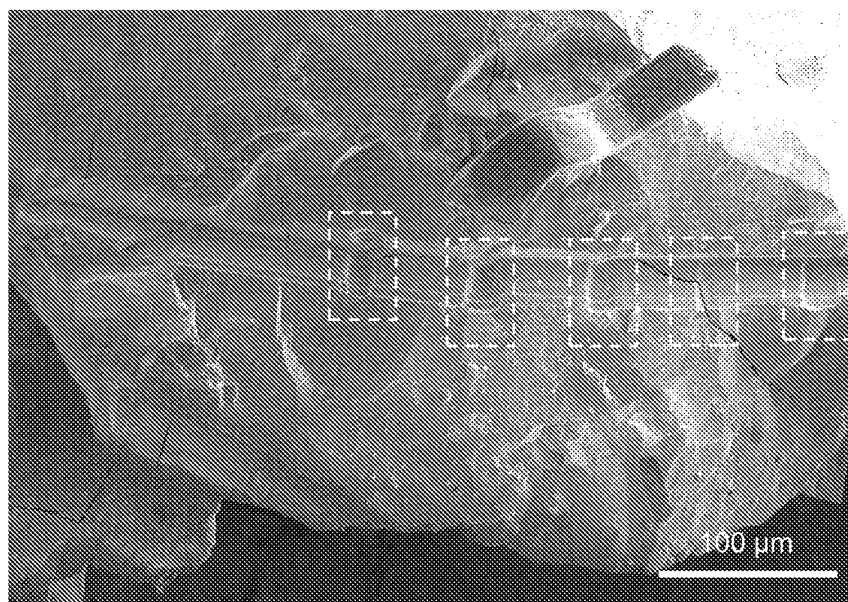
FIG. 27**FIG. 28A**

FIG. 28B

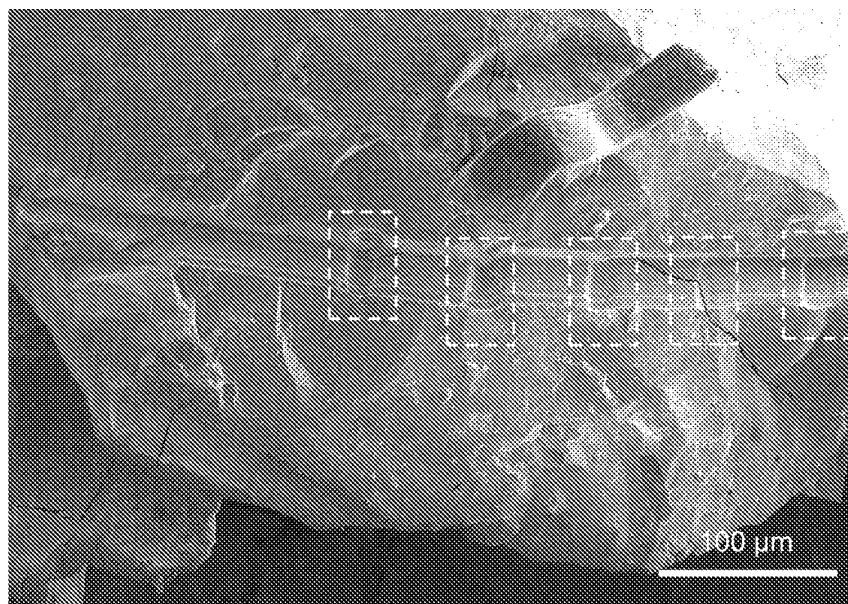


FIG. 29

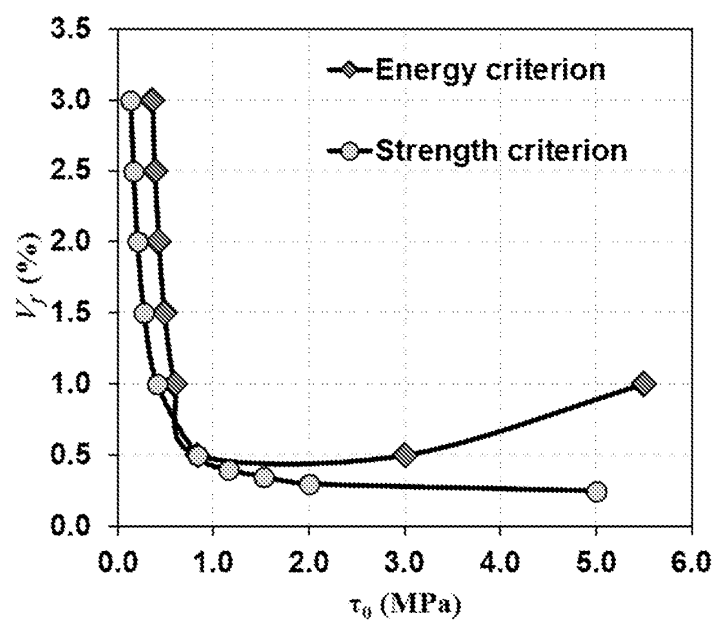


FIG. 30

Fiber dosage	J_b' (J/m ²)	J_{tip} (J/m ²)	σ_0 (MPa)	σ_c (MPa)	PSH _{energy} = J_b'/J_{tip}	PSH _{strength} = σ_0/σ_c
2%	194.96	2.89	12.47	1.00	67.46	12.47
1%	100.68		6.19		34.84	6.19
0.5%	51.39		3.09		17.78	3.09
0.25%	26.03		1.54		9.01	1.54

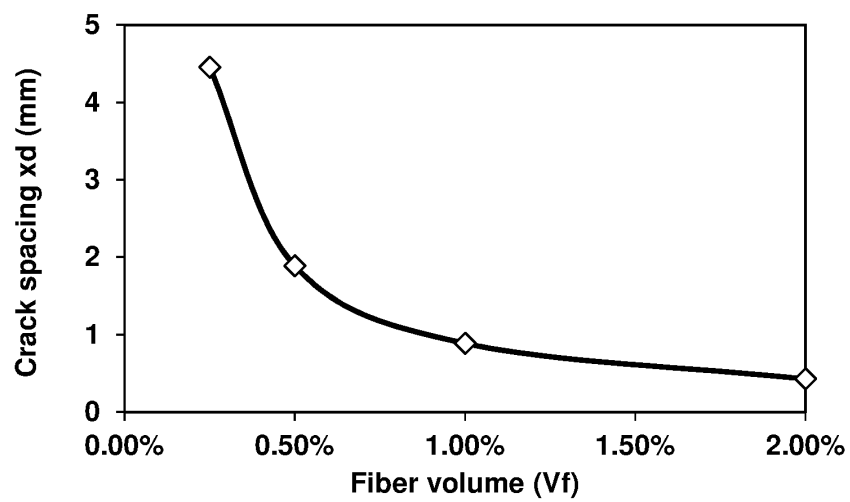
FIG. 31

FIG. 32

Mix	MgO (g)	Micro silica (g)	Water (g)	SHMP (g)	Sand (g)	PE fiber (g)	Binder (%)	Sand (%)	Sand/ Binder ratio
MSH-00	2000	2000	1600	80	0	21	100	0	0
MSH-SS-X	1750	1750	1400	70	437.5	21	88.89	11.11	0.125
MSH-SS-2X	1750	1750	1400	70	875	22	80	20	0.250
MSH-SS-3X	1750	1750	1400	70	1750	22	66.67	33.33	0.500
MSH-SS-4X	1500	1500	1200	60	2000	20	60	40	0.667
MSH-RS-X	1750	1750	1400	70	437.5	21	88.89	11.11	0.125
MSH-RS-2X	1750	1750	1400	70	875	22	80	20	0.250
MSH-RS-3X	1750	1750	1400	70	1750	22	66.67	33.33	0.500
MSH-RS-4X	1500	1500	1200	60	2000	20	60	40	0.667

FIG. 33

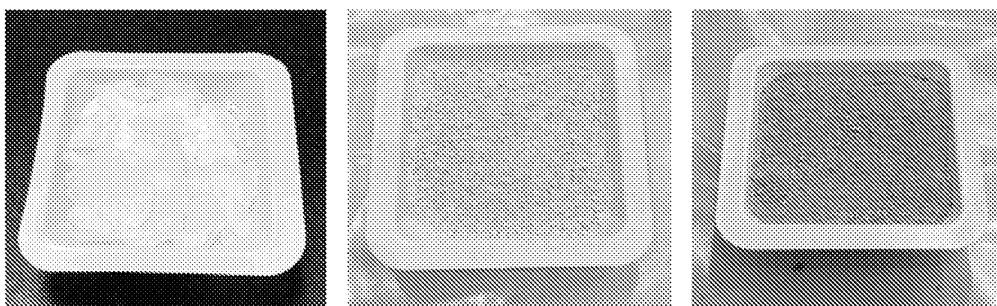


FIG. 34

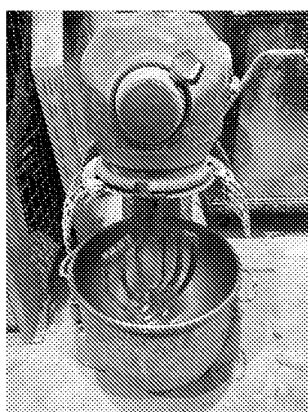


FIG. 35

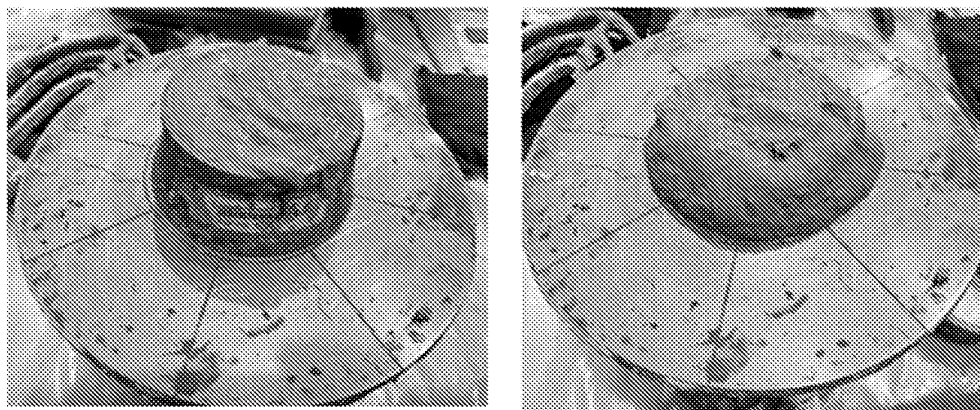


FIG. 36

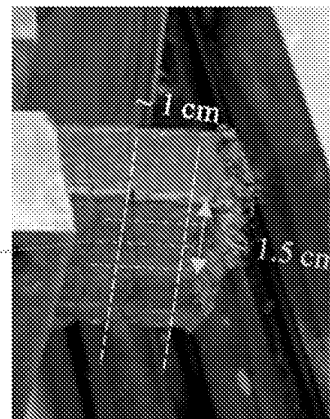
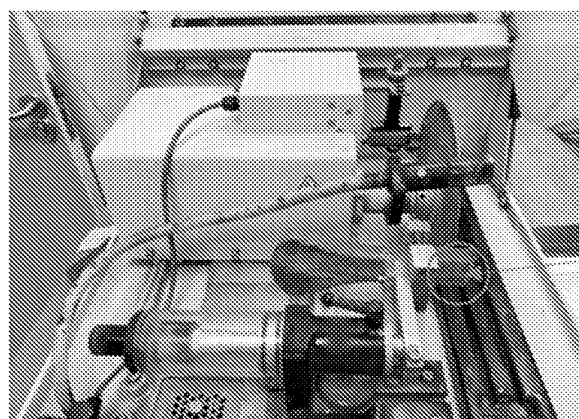


FIG. 37

Mix	Compressive strength (MPa)	Tensile test		
		Initial cracking strength (MPa)	Ultimate tensile stress (MPa)	Tensile strain capacity (%)
MSH-00	88.70 ± 7.2	0.74 ± 0.09	2.46 ± 0.30	14.26 ± 0.52
MSH-SS-X	87.8 ± 3.3	1.10 ± 0.51	3.99 ± 0.31	7.46 ± 0.09
MSH-SS-2X	94.3 ± 6.9	1.7 ± 0.76	3.85 ± 0.24	9.29 ± 0.33
MSH-SS-3X	97.0 ± 4.1	2.45 ± 0.83	3.93 ± 0.66	5.42 ± 1.88
MSH-SS-4X	98.6 ± 3.3	3.27 ± 2.11	4.53 ± 0.54	3.13 ± 1.97

FIG. 38

Mix	Compressive strength (MPa)	Tensile test		
		Initial cracking strength (MPa)	Ultimate tensile stress (MPa)	Tensile strain capacity (%)
MSH-00	88.70 ± 7.2	0.74 ± 0.09	2.46 ± 0.30	14.26 ± 0.52
MSH-RS-X	75.3 ± 1.5	0.67 ± 0.27	2.58 ± 0.30	8.55 ± 1.03
MSH-RS-2X	85.6 ± 3.5	1.25 ± 0.72	2.93 ± 0.18	9.07 ± 0.25
MSH-RS-3X	74.5 ± 1.7	1.75 ± 0.71	1.73 ± 0.04	6.85 ± 0.56
MSH-RS-4X	75.4 ± 1.4	1.01 ± 0.92	1.49 ± 0.45	2.56 ± 0.09

FIG. 39

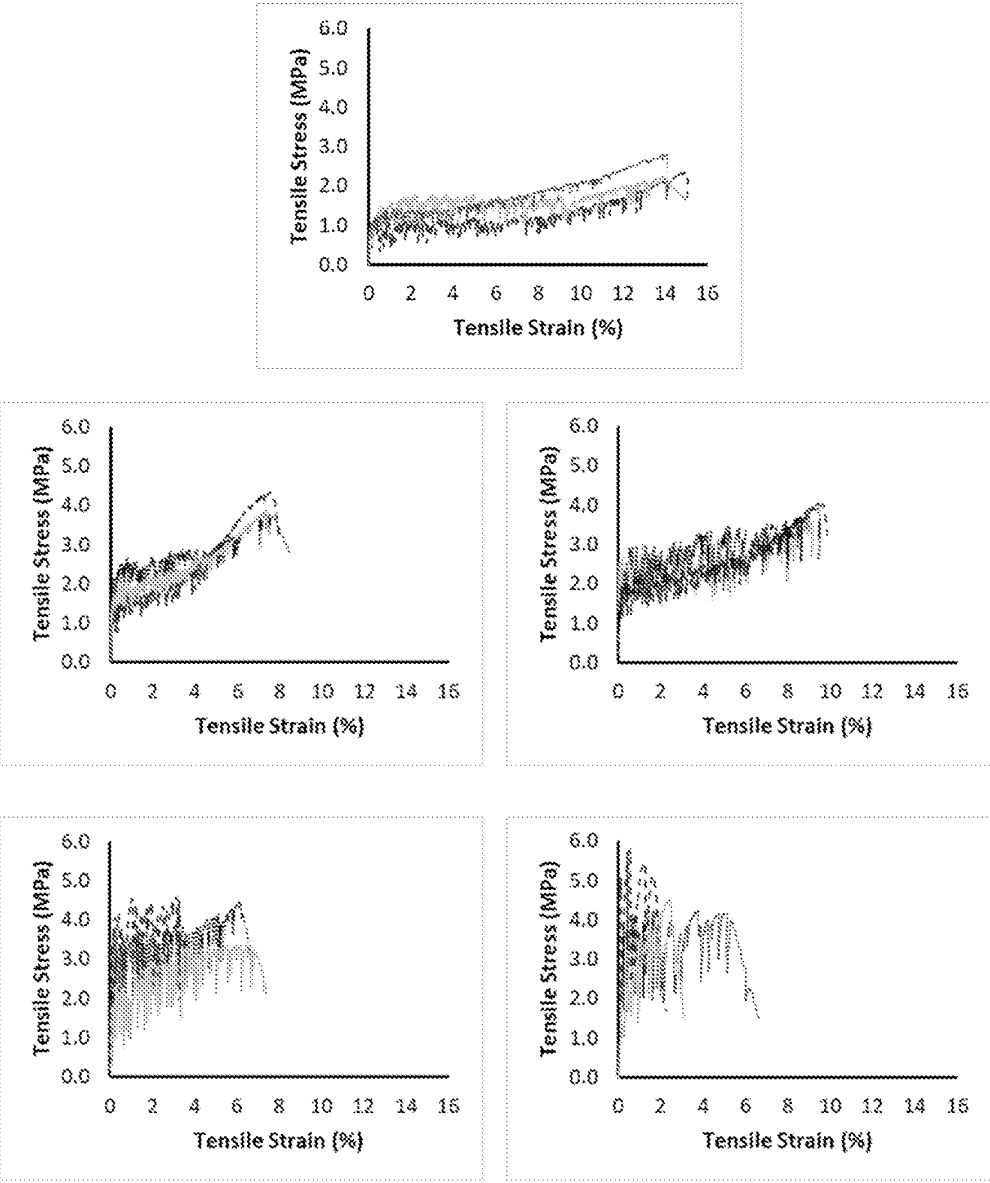


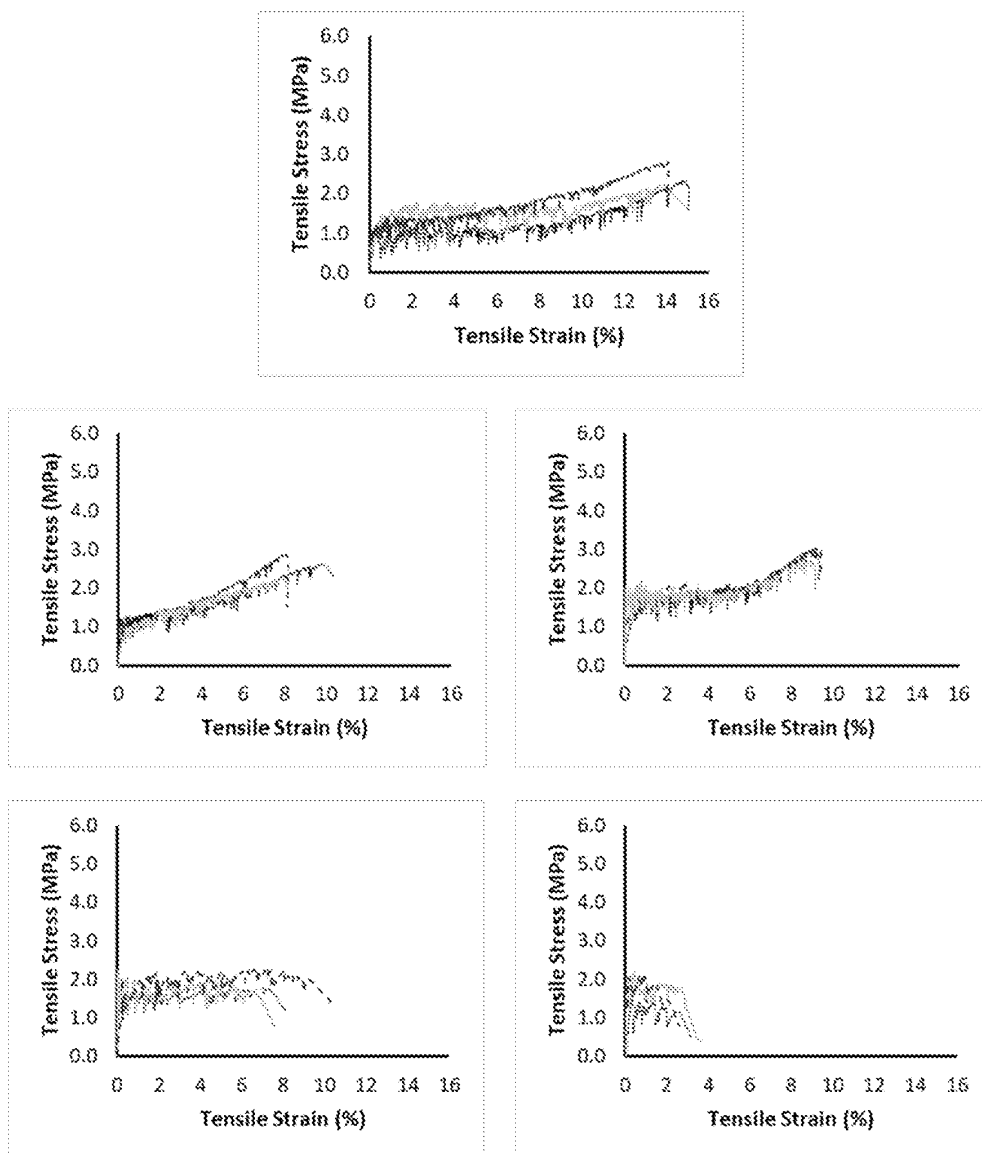
FIG. 40

FIG. 41

Mix	Sand/Binder Ratio	Average number of cracks	Average crack width (μm)	Average crack spacing (mm)
MSH-00	0	262	125.6 ± 71.0	1.49
MSH-SS-X	0.125	231	91.3 ± 51.4	1.69
MSH-SS-2X	0.250	242	90.8 ± 71.5	1.61
MSH-SS-3X	0.500	128	143.7 ± 116.0	3.28
MSH-SS-4X	0.667	35	209.9 ± 154.2	12.0

FIG. 42

Mix	Sand/Binder Ratio	Average number of cracks	Average crack width (μm)	Average crack spacing (mm)
MSH-00	0	262	125.6 ± 71.0	1.49
MSH-RS-X	0.125	258	78.7 ± 52.9	1.51
MSH-RS-2X	0.250	294	76.3 ± 41.4	1.33
MSH-RS-3X	0.500	216	84.6 ± 72.1	1.81
MSH-RS-4X	0.667	135	47.9 ± 58.2	3.11

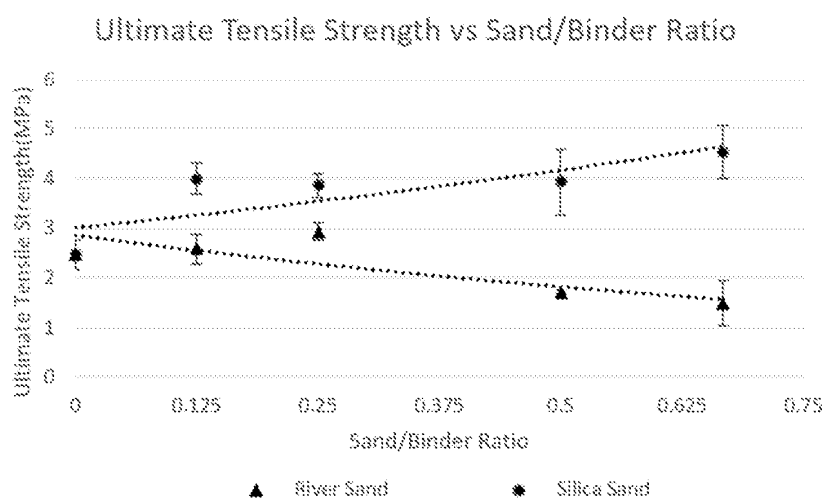
FIG. 43

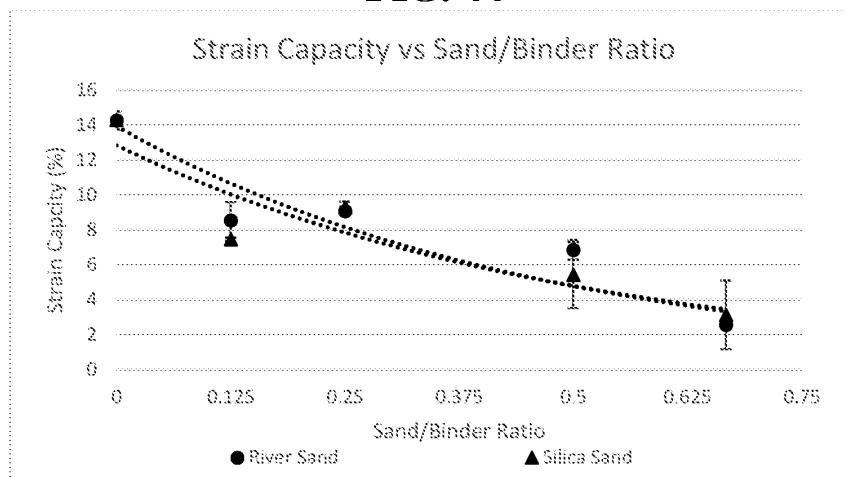
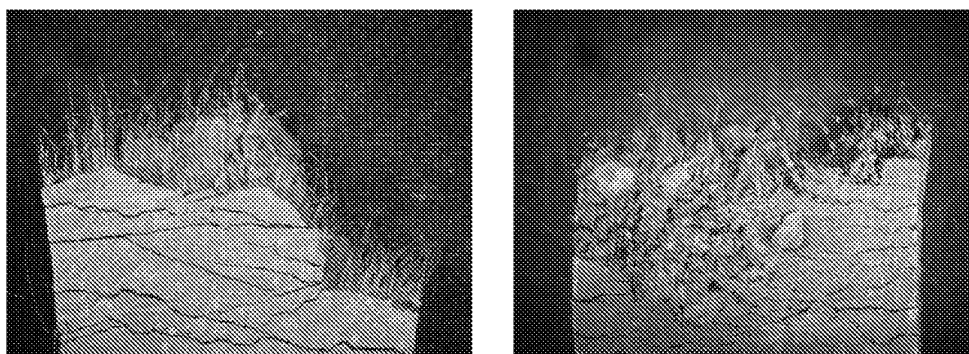
FIG. 44**FIG. 45**

FIG. 46

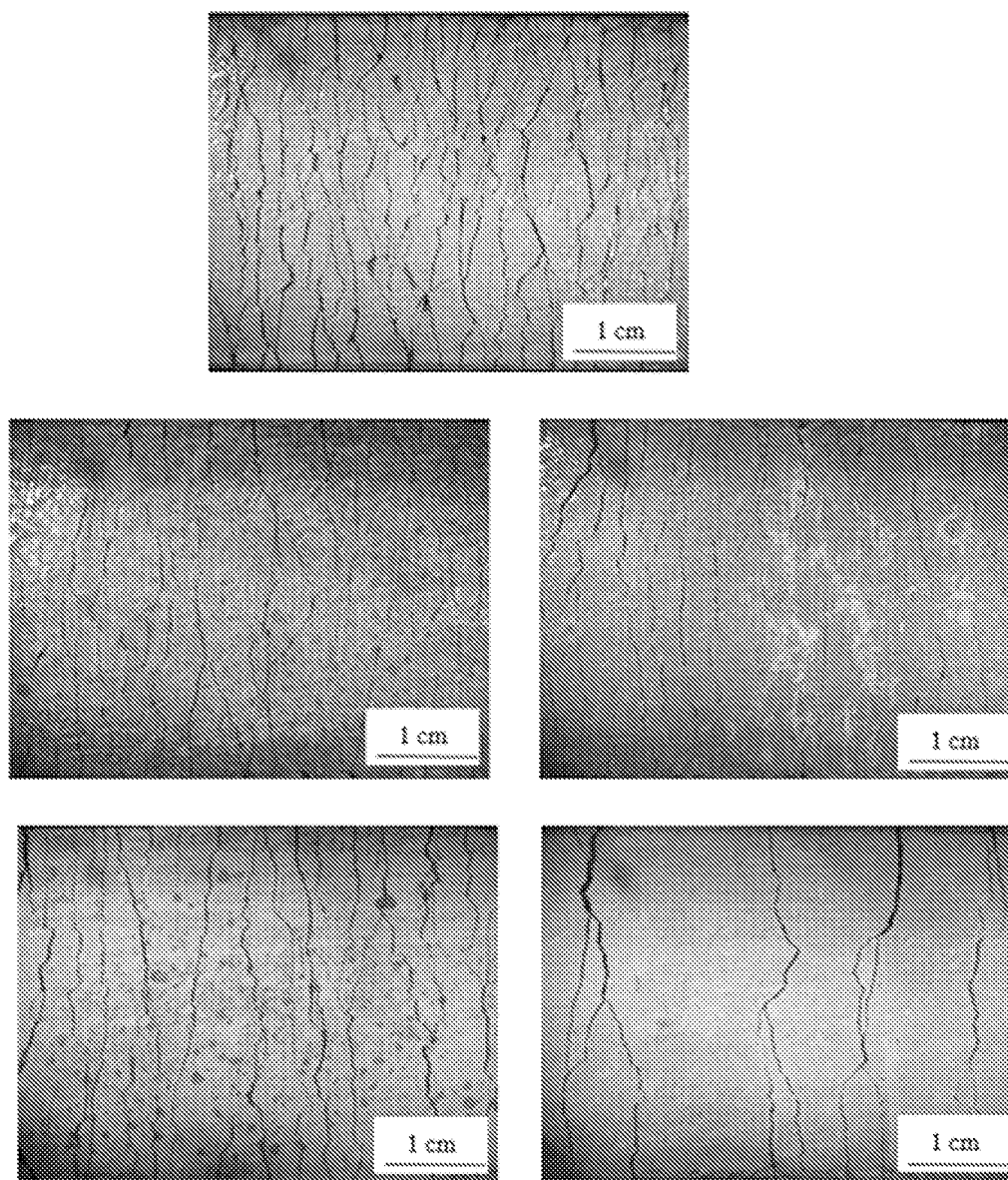


FIG. 47

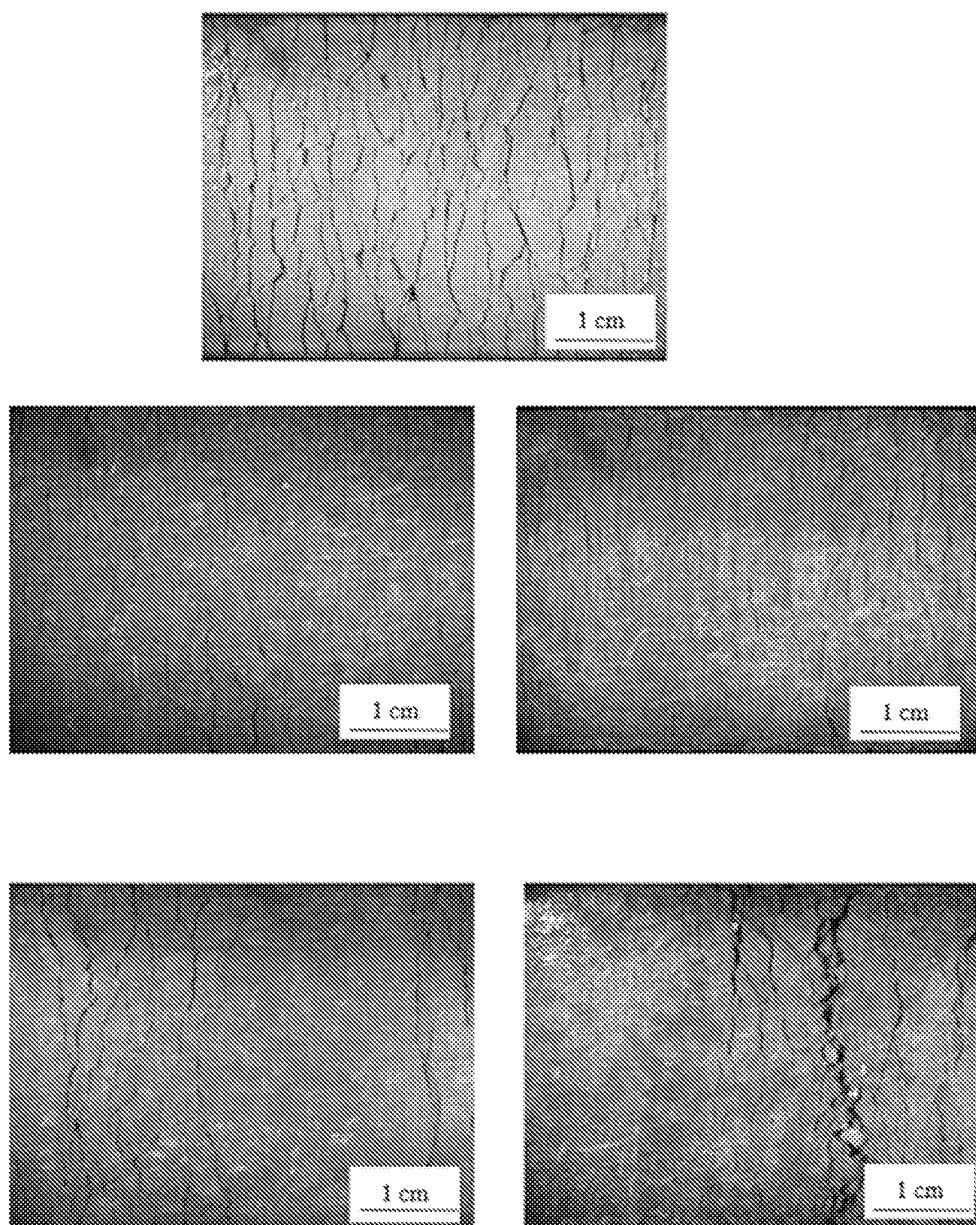


FIG. 48

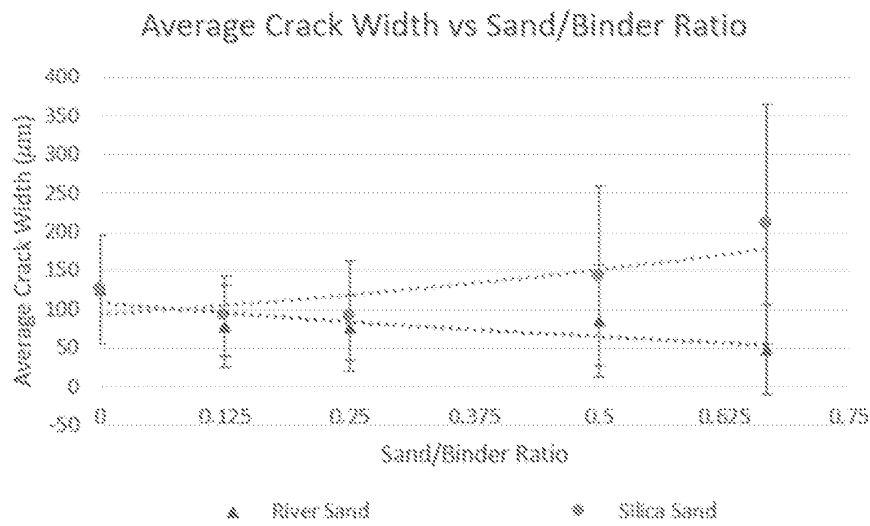


FIG. 49

