coatings

MDPI

Supplementary Material

Modified Graphene Micropillar Array Superhydrophobic Coating with Strong Anti-Icing Properties and Corrosion Resistance

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Table S1. The parameters of the commercial PET nets.

Mesh number	Mesh size (μm)	Wire diameter (μm)
80	267±2	50±2
100	200±2	50±2
120	165±2	50±2
160	108±2	50±2
200	77±2	50±2

Table S2. The component A of varnish coating.

Material	Specification	Composition (%)
Resin	F301	65
Mixed solution	M_{xylene}： $M_{butyl\ ester}$=8:2	34
Defoamer	BYK065	0.4
Levelling agent	BYK306	0.6

Table S3. The element content of GP and AC-FAS-GP.

	Si2p（at%）	C1s（at%）	O1s（at%）	F1s（at%）
GP	——	91.81	8.19	——
AC-FAS-GP	1.13	72.59	3.61	22.67

Tables S4-S8 exhibit the electrochemical parameters of Q80G-Q200G coatings. Among them, the relationship between Q and C is described by the following formula:

$C = Q^{1/n}(1/R_s + 1/R)^{n-1/n}$

where n represents the surface roughness index.

Table S4. The electrochemical parameters of the Q80G coating obtained through the equivalent circuit fitting.

Time (days)	R_s ($\Omega \cdot cm^2$)	Q_{GC} ($10^{-10} S \cdot s^{\alpha}/cm^2$)	n_{GC}	R_{GC} ($\Omega \cdot cm^2$)	Q_{FC} ($S \cdot s^{\alpha}/cm^2$)	n_{FC}	R_{FC} ($\Omega \cdot cm^2$)	Q_{dl} ($S \cdot s^{\alpha}/cm^2$)	n_{dl}	R_{ct} ($\Omega \cdot cm^2$)	W	C_{GC} ($F \cdot cm^2$)	C_{FC} ($F \cdot cm^2$)	C_{dl} ($F \cdot cm^2$)
0.25	0.05701	7.82	0.921	6.61E3	3.00E-6	0.950	6.60E4	7.18E-6	0.693	2.09E4	——	1.0E-10	1.3E-6	1.0E-8
1	214.6	5.02	0.963	6.10E3	2.08E-5	0.959	1.01E4	6.96E-5	0.390	7.70E3	——	2.7E-10	1.7E-5	9.3E-8
2	237.5	8.82	0.926	4.72E3	9.10E-5	0.944	7.39E3	3.20E-5	0.564	4.35E3	——	2.6E-10	7.2E-5	7.0E-7
3	0.08086	56.3	0.792	3.79E3	5.96E-5	0.942	7.46E3	1.33E-5	0.776	2.89E3	5.4E-4	2.0E-11	2.8E-5	2.5E-7
5	0.00753	115	0.741	2.77E3	9.71E-5	0.873	5.38E3	7.70E-6	0.825	2.63E3	1.1E-3	3.5E-12	1.2E-5	2.2E-7
7	0.02336	191	0.712	2.83E3	3.96E-4	0.813	2.15E3	9.97E-6	0.806	2.39E3	2.1E-2	3.1E-12	2.8E-5	2.5E-7
9	0.00230	424	0.657	2.83E3	1.88E-4	0.947	2.61E3	1.23E-5	0.771	2.57E3	1.6E-3	2.5E-13	8.3E-5	7.1E-8
12	0.01645	184	0.713	2.93E3	2.26E-4	0.955	2.31E3	1.91E-5	0.682	2.64E3	1.8E-3	2.7E-11	1.3E-4	1.8E-8
16	0.02626	441	0.661	3.72E3	2.02E-4	0.811	3.72E3	4.01E-5	0.617	2.12E3	1.8E-3	1.2E-11	1.2E-5	7.6E-9

Table S5. The electrochemical parameters of the Q100G coating obtained through the equivalent circuit fitting.

Time (days)	R_s ($\Omega \cdot cm^2$)	Q_{GC} ($S \cdot s^{\alpha}/cm^2$)	n_{GC}	R_{GC} ($\Omega \cdot cm^2$)	Q_{FC} ($S \cdot s^{\alpha}/cm^2$)	n_{FC}	R_{FC} ($\Omega \cdot cm^2$)	Q_{dl} ($S \cdot s^{\alpha}/cm^2$)	n_{dl}	R_{ct} ($\Omega \cdot cm^2$)	W	C_{GC} ($F \cdot cm^2$)	C_{FC} ($F \cdot cm^2$)	C_{dl} ($F \cdot cm^2$)
0.25	0.0116	7.75E-10	0.889	2.20E4	1.00E-6	0.884	2.46E5	6.88E-06	0.999	1.28E5	——	3.3E-11	9.0E-8	6.9E-6
1	0.08305	7.29E-10	0.896	2.10E4	3.29E-6	0.840	2.11E5	1.86E-05	0.531	1.78E4	——	4.5E-11	1.8E-7	1.4E-10
2	513.1	2.74E-10	0.968	2.62E4	4.09E-6	0.801	7.00E5	1.82E-05	0.713	5.83E3	——	1.6E-10	8.8E-7	2.7E-6
3	752.1	2.98E-10	0.965	2.76E4	7.68E-6	0.770	2.40E6	9.01E-05	0.432	1.30E3	——	1.7E-10	1.6E-6	1.4E-6
5	647.9	3.09E-10	0.960	2.17E4	4.15E-6	0.828	2.18E5	4.66E-06	0.816	1.70E4	——	1.6E-10	1.2E-6	1.3E-6
7	495.8	3.98E-10	0.942	2.46E4	1.71E-5	0.855	7.63E4	2.85E-05	0.646	3.89E3	——	1.5E-10	7.6E-6	2.6E-6
9	352	3.62E-10	0.956	2.22E4	2.99E-5	0.908	2.54E4	8.30E-05	0.216	1.14E4	——	1.7E-10	1.9E-5	2.0E-10
12	656.4	2.70E-	0.97	2.50E	4.95E-	0.88	9.16E	1.50E-	0.27	1.19E	——	1.8E-	13.2E-	2.8E-7

		10	3	4	5	8	4	04	5	4		0	5	
16	146.5	3.42E-10	0.95	2.10E4	8.41E-5	0.90	1.61E4	3.98E-05	0.24	5.72E3	——	1.6E-10	15.2E-5	5.9E-12

Table S6. The electrochemical parameters of the Q120G coating obtained through the equivalent circuit fitting.

Time (days)	R_s (Ω·cm^2)	Q_{GC} (S·s$^\alpha$/cm^2)	n_{GC}	R_{GC} (Ω·cm^2)	Q_{FC} (S·s$^\alpha$/cm^2)	n_{FC}	R_{FC} (Ω·cm^2)	Q_{dl} (S·s$^\alpha$/cm^2)	n_{dl}	R_{ct} (Ω·cm^2)	W	C_{GC} (F·cm^2)	C_{FC} (F·cm^2)	C_{dl} (F·cm^2)
0.25	446.8	2.05E-10	0.98	2.41E4	3.90E-6	0.74	3.33E5	1.90E-5	0.79	1.91E5	——	1.5E-10	14.2E-7	5.7E-6
1	417.3	2.75E-10	0.96	1.62E4	2.31E-4	0.81	1.66E4	7.79E-6	0.74	2.32E3	——	1.4E-10	11.3E-4	9.9E-7
2	0.01435	3.80E-10	0.92	2.24E4	9.04E-7	0.90	1.90E5	5.17E-5	0.99	1.74E4	——	5.3E-11	11.3E-7	5.2E-5
3	10	3.90E-10	0.92	1.66E4	1.20E-5	0.65	2.71E5	2.76E-5	0.99	3.73E4	——	8.5E-11	19.5E-8	2.8E-5
5	581.1	2.38E-10	0.97	1.69E4	1.14E-5	0.81	2.12E5	5.62E-5	0.38	1.17E4	——	1.5E-10	13.7E-6	2.0E-7
7	657.2	2.31E-10	0.97	1.95E4	1.63E-5	0.85	1.93E5	7.97E-5	0.32	9.27E3	——	1.6E-10	17.7E-6	1.5E-7
9	863.3	2.11E-10	0.98	2.48E4	2.42E-5	0.81	6.60E4	5.76E-5	0.42	3.11E3	——	1.6E-10	11.0E-5	7.5E-7
12	784.3	2.44E-10	0.97	2.56E4	2.93E-5	0.92	5.01E4	5.60E-5	0.48	4.94E3	——	1.5E-10	12.1E-5	1.7E-6
16	779.5	2.82E-10	0.96	1.59E4	2.37E-4	0.88	1.45E4	9.03E-6	0.65	3.62E3	——	1.5E-10	11.9E-4	5.9E-7

Table S7. The electrochemical parameters of the Q160G coating obtained through the equivalent circuit fitting.

Time (days)	R_s (Ω·cm^2)	Q_{GC} (S·s$^\alpha$/cm^2)	n_{GC}	R_{GC} (Ω·cm^2)	Q_{FC} (S·s$^\alpha$/cm^2)	n_{FC}	R_{FC} (Ω·cm^2)	Q_{dl} (S·s$^\alpha$/cm^2)	n_{dl}	R_{ct} (Ω·cm^2)	W	C_{GC} (F·cm^2)	C_{FC} (F·cm^2)	C_{dl} (F·cm^2)
0.25	899.4	3.77E-10	0.95	1.46E4	8.96E-6	0.99	7.79E5	7.82E-6	0.62	2.07E5	——	1.8E-10	19.0E-6	3.7E-7
1	892.8	3.49E-10	0.95	1.53E4	1.80E-6	0.80	5.31E5	6.10E-7	0.99	3.49E2	——	1.8E-10	13.8E-7	6.1E-7
2	158.5	6.03E-10	0.90	1.63E4	9.85E-7	0.86	3.94E5	2.91E-6	0.99	3.75E5	——	1.1E-10	12.4E-7	2.9E-6
3	468.8	4.57E-10	0.93	1.58E4	3.30E-6	0.90	9.25E5	3.38E-6	0.75	3.63E5	——	1.4E-10	11.7E-6	4.3E-7
5	910.5	3.90E-	0.94	1.71E	5.35E-	0.78	1.42E	1.94E-	0.86	1.57E	——	1.7E-	11.2E-	1.0E-

		10	9	4	6	4	6	5	1	5		0	6	5
7	527.5	4.17E-10	0.93	1.41E	5.50E-6	0.80	9.24E	9.45E-6	0.70	1.56E	——	1.5E-0	1.3E-6	9.8E-7
			8	4		5	5		2	4				
9	934.6	3.67E-10	0.95	1.66E	1.61E-5	0.86	4.26E	3.17E-5	0.50	1.78E	——	1.8E-0	1.8E-6	9.1E-7
			3	4		4	5		2	4				
12	712.9	3.81E-10	0.94	1.70E	1.29E-5	0.80	1.81E	2.81E-5	0.57	7.75E	——	1.6E-0	1.4E-6	1.4E-6
			6	4		6	6		0	3				
16	898.1	4.00E-10	0.94	1.75E	8.28E-6	0.82	1.06E	3.63E-5	0.53	7.48E	——	1.7E-0	1.9E-6	1.6E-6
			6	4		2	6		1	3				

Table S8. The electrochemical parameters of the Q200G coating obtained through the equivalent circuit fitting.

Time (days)	R_s ($\Omega \cdot cm^2$)	Q_{GC} ($S \cdot s^{\alpha}/cm^2$)	n_{GC}	R_{GC} ($\Omega \cdot cm^2$)	Q_{FC} ($S \cdot s^{\alpha}/cm^2$)	n_{FC}	R_{FC} ($\Omega \cdot cm^2$)	Q_{dl} ($S \cdot s^{\alpha}/cm^2$)	n_{dl}	R_{ct} ($\Omega \cdot cm^2$)	W	C_{GC} ($F \cdot cm^2$)	C_{FC} ($F \cdot cm^2$)	C_{dl} ($F \cdot cm^2$)
0.25	1081	3.19E-10	0.93	2.14E	2.37E-6	0.81	2.86E	2.69E-6	0.79	3.78E	——	1.1E-0	1.0E-7	5.9E-7
			4	4		3	6		4	5				
1	1037	3.07E-10	0.93	2.19E	1.82E-6	0.77	6.98E	1.24E-5	0.77	5.71E	——	1.1E-0	1.0E-7	3.5E-6
			6	4		7	5		4	5				
2	1799	2.91E-10	0.94	2.82E	2.15E-6	0.77	8.17E	5.29E-6	0.57	4.83E	——	1.2E-0	1.1E-7	1.8E-7
			5	4		0	5		8	5				
3	2281	2.88E-10	0.95	3.39E	1.00E-5	0.67	1.13E	3.87E-6	0.78	7.62E	——	1.4E-0	1.6E-6	1.1E-6
			2	4		4	6		9	5				
5	2033	2.78E-10	0.95	3.67E	4.52E-6	0.74	1.66E	5.78E-6	0.80	5.78E	——	1.3E-0	1.1E-7	1.2E-6
			2	4		5	6		2	5				
7	2326	2.98E-10	0.95	4.40E	5.67E-6	0.70	9.97E	5.15E-6	0.89	3.16E	1.2E-4	1.4E-0	1.4E-7	3.1E-6
			1	4		7	5		9	5				
9	0.0193	1.92E-10	0.99	3.94E	1.73E-6	0.85	2.31E	1.07E-7	0.54	8.14E	6.5E-6	1.9E-0	1.5E-8	7.7E-15
			9	4		1	6		9	3				
12	6.428	1.31E-10	0.98	4.02E	1.89E-6	0.84	1.69E	1.36E-10	0.87	9.25E	1.0E-5	1.0E-0	1.2E-7	6.6E-12
			8	4		2	6		4	3				
16	0.03909	1.95E-10	0.99	3.81E	1.74E-6	0.86	2.17E	1.97E-7	0.51	8.36E	8.4E-6	1.9E-0	1.3E-7	3.7E-15
			9	4		5	6		2	3				

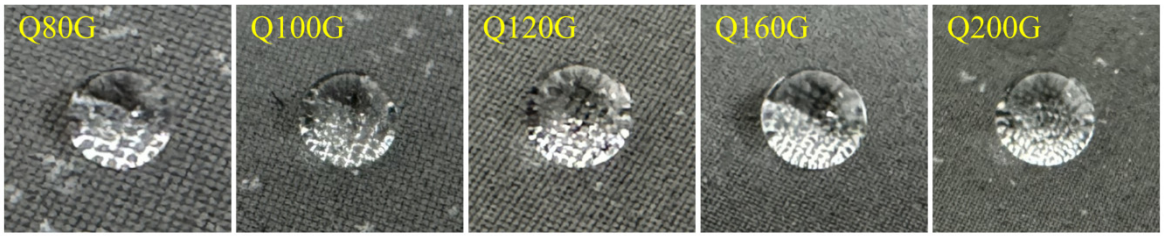

Figure S1. Silver mirror effect of Q80G, Q100G, Q120G, Q160G, and Q200G coatings at room temperature and at conditions of -10 °C and 60 % relative humidity, respectively.