

Fig. S1 shows the AFM surface morphologies of the multilayer DLC coatings. As is seen in Fig. S1, the surface roughness of multilayer DLC coatings is 3.16, 2.80, 2.62 and 2.73 nm, respectively.

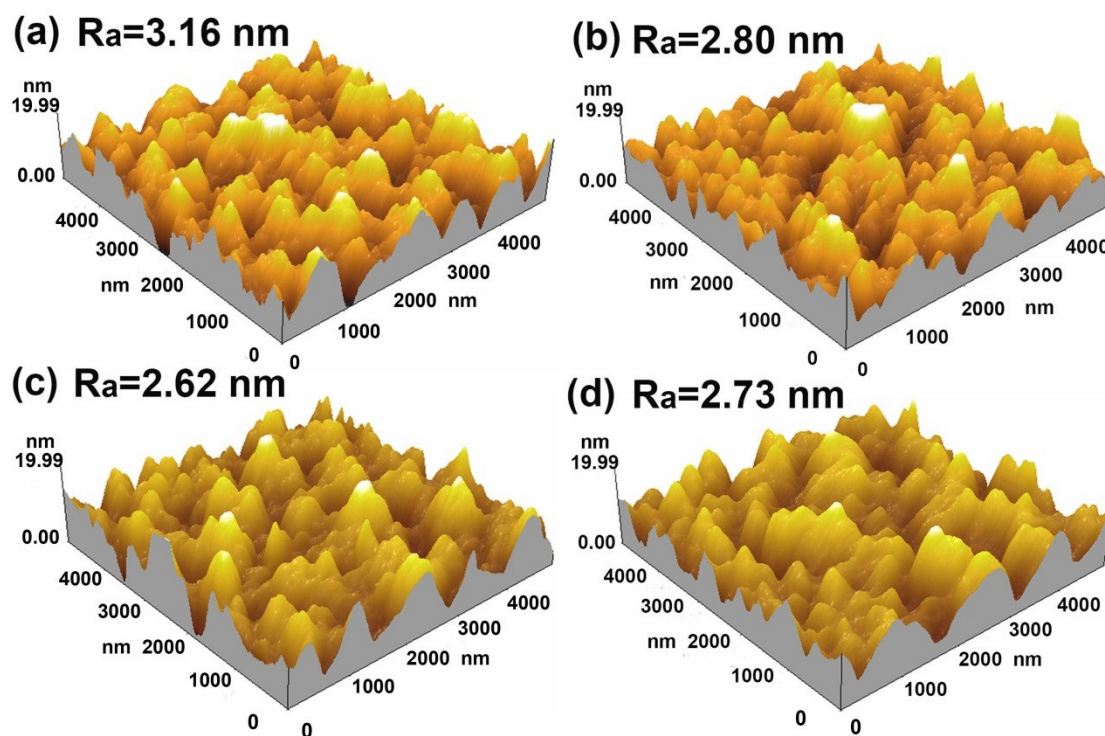


Fig. S1. AFM surface morphologies of the multilayer DLC coatings. (a) 5 deposition periods, (b) 12 deposition periods, (c) 15 deposition periods, (d) 20 deposition periods

Fig. S2 shows the macroscopic photographs of the samples after the 720 h salt spray test. All coatings showed signs of corrosion after 720 h salt spray test, usually near the edges. However, there is no significant difference in the corroded surface between four samples.

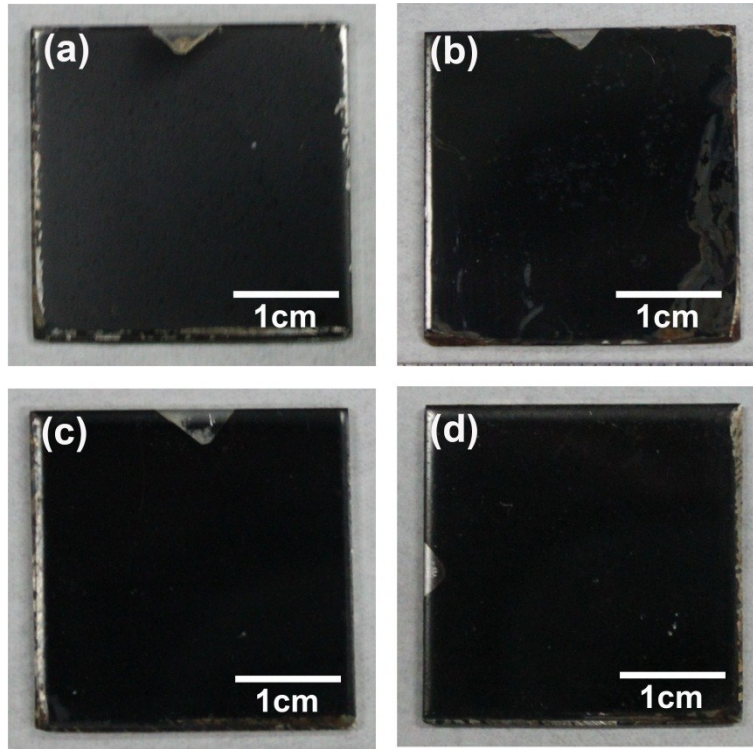


Fig. S2. The macroscopic photographs of the samples after the 720 h salt spray test. (a) 5 deposition periods, (b) 12 deposition periods, (c) 15 deposition periods, (d) 20 deposition periods.

Table S1 summarizes the detailed deposition parameters of multilayer DLC coatings with different deposition periods. In our experiment, we deposit the coating with the constant thickness ($10\ \mu\text{m}$) and thickness ratio. We choose the thickness ratio as 6:1 ($\text{Si}_x\text{-DLC}:\text{Si}_y\text{-DLC}=6:1$). In our previous deposition process, we calculate the deposition rate for $\text{Si}_x\text{-DLC}$ and $\text{Si}_y\text{-DLC}$, which is $35\ \text{nm}\cdot\text{min}^{-1}$ and $23\ \text{nm}\cdot\text{min}^{-1}$, respectively. Therefore, taking the coating with 5 deposition periods, we can obtain two formulae: (1) $35t_x/23t_y=6:1$ and (2) $5\times 35t_x+5\times 23t_y=10000$. By calculation, we can obtain $t_x=48\text{min}$ and $t_y=12\text{min}$. By that analogy, we can obtain the deposition time for the coating with 12, 15 and 20 deposition periods.

Table S1 The detailed deposition parameters of multilayer DLC coatings with different deposition periods.

Deposition periods	Time for single		Gas flow (sccm)		
	deposition period (min)		Ar	SiH ₄	C ₂ H ₂
	Si _x -DLC	Si _y -DLC			
5	48	12			
12	20	5	100	50	Si _x -DLC: 150
15	16	4			Si _y -DLC: 50
20	12	3			

Table S2 summarizes the fitting results obtained from the equivalent circuits. It can be seen that the impedance value of the coating in 3.5wt.%NaCl, 1M H₂SO₄, 1M HCl and 1M NaOH solutions is 9.4×10^7 , 7.2×10^7 , 6.3×10^7 and 2.6×10^6 , respectively.

Table S2 Fitting results of the multilayer DLC coating under various corrosive solutions according to the equivalent circuits in Fig. 6c and Fig. 10b.

Corrosive solutions	R _c (Ω.cm ²)	n	CPE _c (Ω ⁻¹ .cm ⁻²)	W ₁ (Ω.cm ²)	--	--
3.5wt.%NaCl	9.4×10^7	0.93	2.2×10^{-10}	4.1×10^7	--	--
1M H ₂ SO ₄	7.2×10^7	0.88	6.0×10^{-10}	2.8×10^7	--	--
1M HCl	6.3×10^7	0.91	2.5×10^{-10}	2.0×10^6	--	--
	R _c (Ω.cm ²)	n	CPE _c (Ω ⁻¹ .cm ⁻²)	R ₁ (Ω.cm ²)	n ₂	CPE ₁ (Ω ⁻¹ .cm ⁻²)
1M NaOH	2.6×10^6	0.81	1.4×10^{-9}	2.3×10^7	0.85	6.3×10^{-9}