Concrete inspired superhydrophobic nanocomposite coating with high robustness

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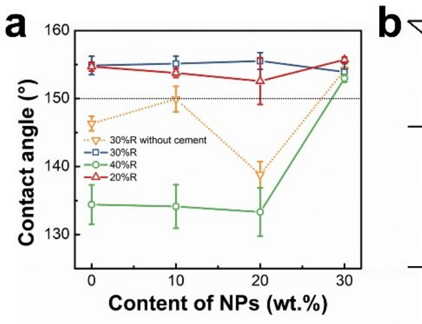

b

	R：20%	30%	30% (without cement)	40%
NPs:0%	-	-	-	-
10%	0.4m	0.4m	-	-
20%	0.4m	-	-	-
30%	0.4m	3.6m	0.4m	0.4m

Fig. S1 (a) The effect of NPs on the wettability of coatings with different resin content. Comparing with sample with organic/inorganic hybrid resin (blue line), the sample without cement clearly have a poor performance in wettability, indicating that cement is also conducive to achieving superhydrophobicity. (b) Sandpaper abrasion test results for the corresponding superhydrophobic samples in S1a.

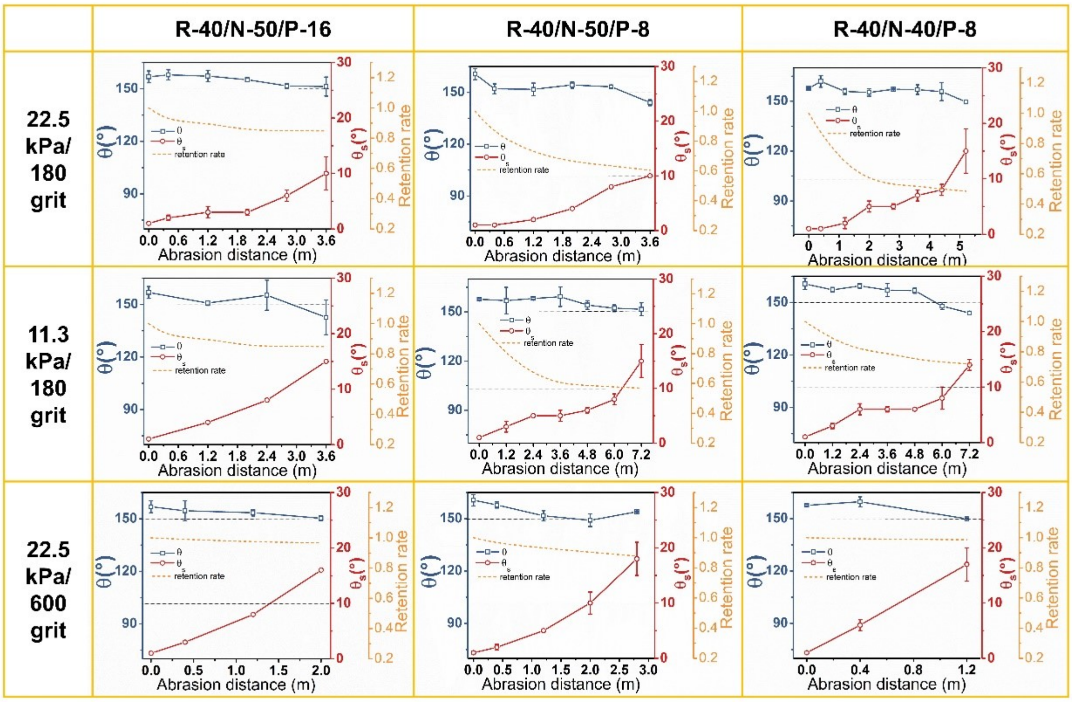

Fig. S2 Abrasion test results of sample R-40/N-50/P-16, R-40/N-50/P-8 and R-40/N-50/P-8. Clearly, these samples have a better performance when abraded by 180 grit sandpaper with a load of 11.3 kPa.

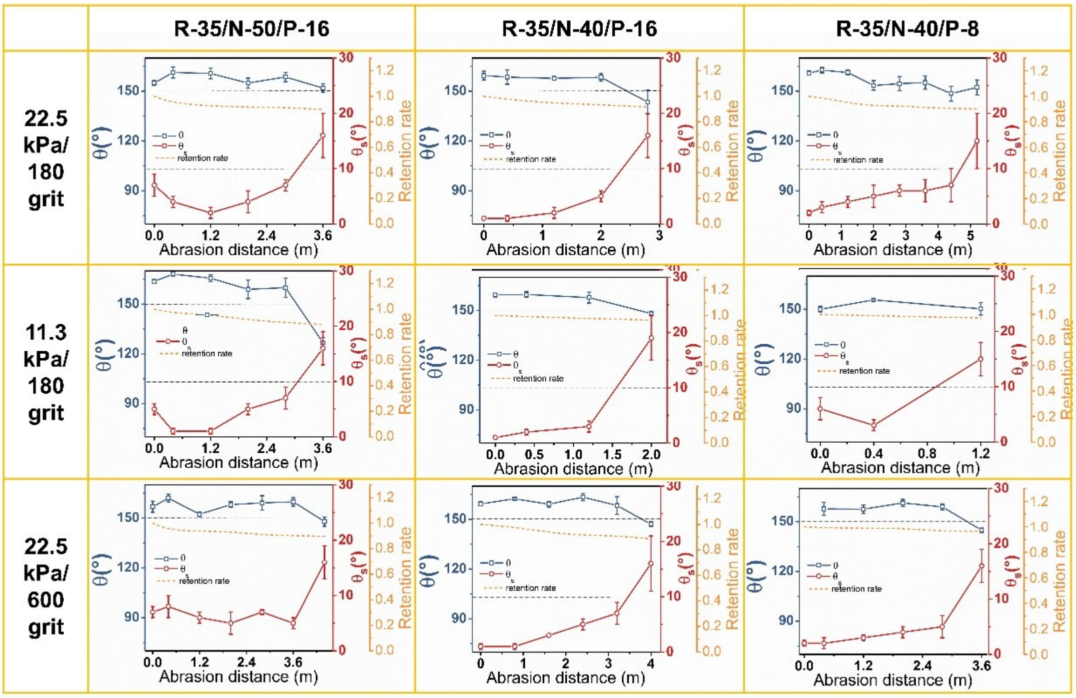

Fig. S3 Abrasion test results of sample R-35/N-50/P-16, R-35/N-40/P-16 and R-35/N-40/P-8.

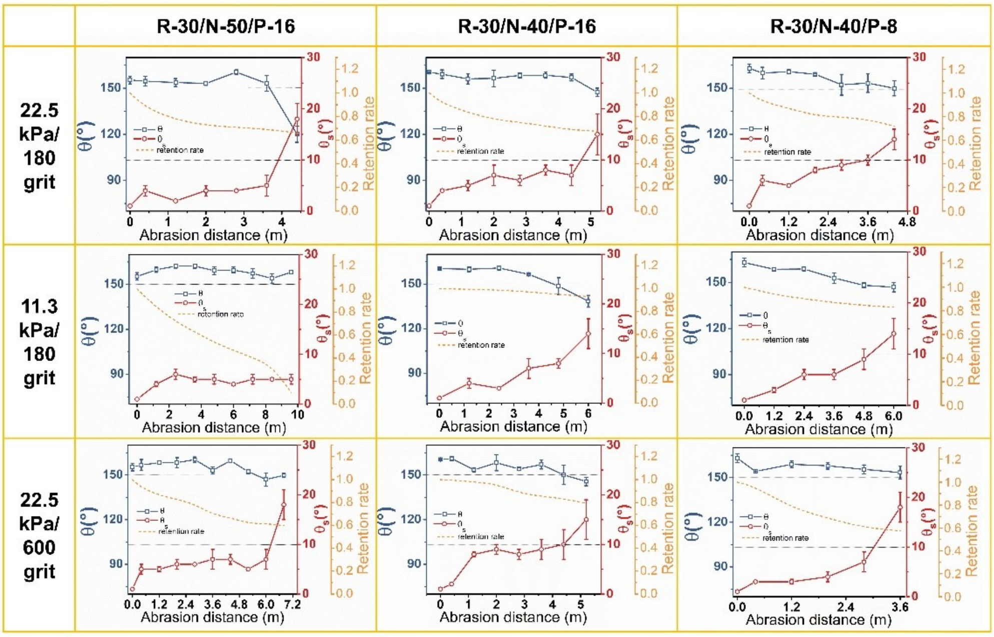

Fig. S4 Abrasion test results of sample R-30/N-50/P-16, R-30/N-40/P-16 and R-30/N-40/P-8. Comparing with results ahead, clearly samples with less resin content have a better performance in abrasion test for all test conditions.

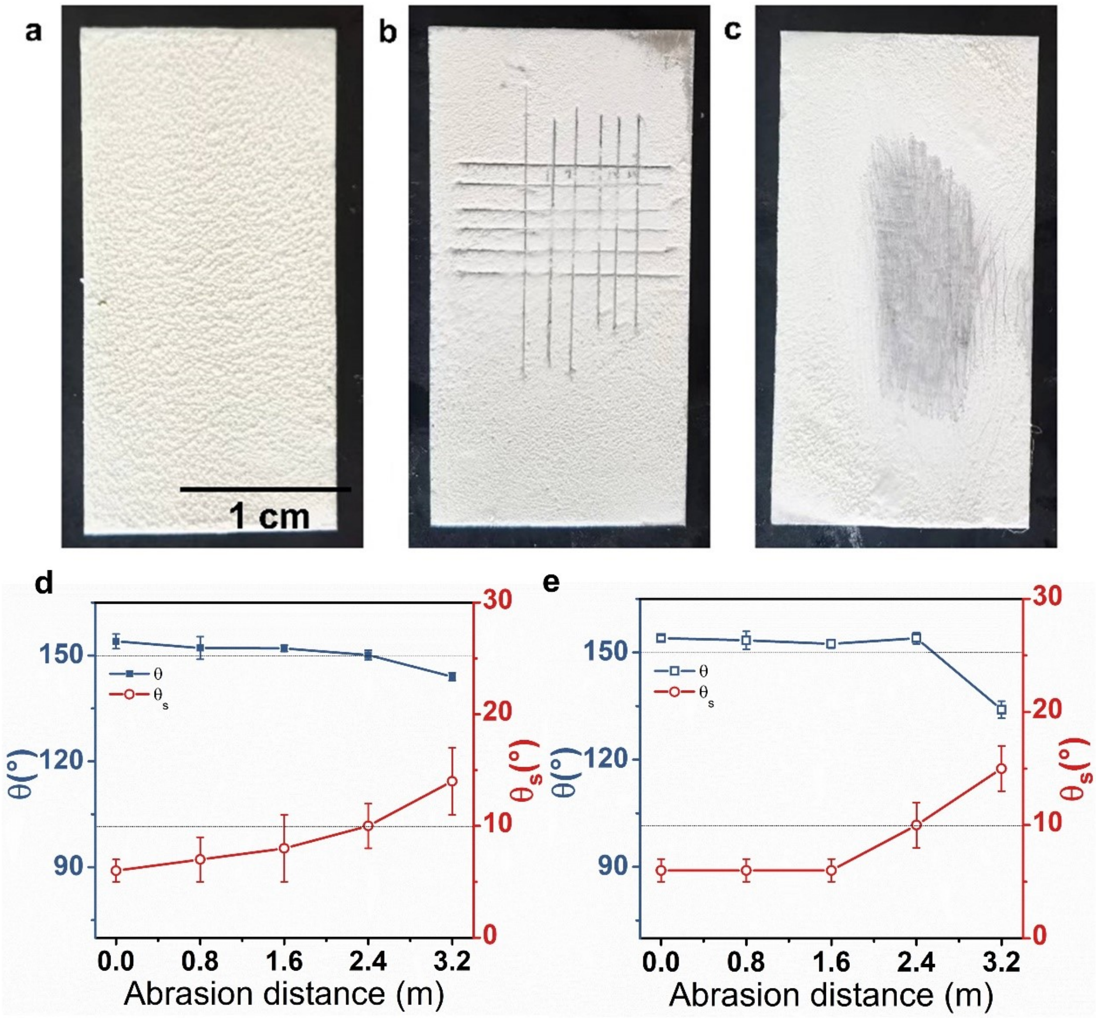

Fig. S5 (a) Sample of fabricated with NPs only. (b) Cross-hatch tape peel test performed following ASTM standard D3359-17 for the sample, and ranks 5B. (c) The post-tested sample after abraded by 180 grit sandpaper only for 0.2 m, indicating a poor abrasion resistance. The abrasion test results for sample R-35/N-40/P-8 without the addition of concrete, in both situations, 22.5 kPa load with 180 grit sandpaper for (d) and 22.5 kPa with 600 grit sandpaper for (e), the sample failed after abrasion of 3.2 m.

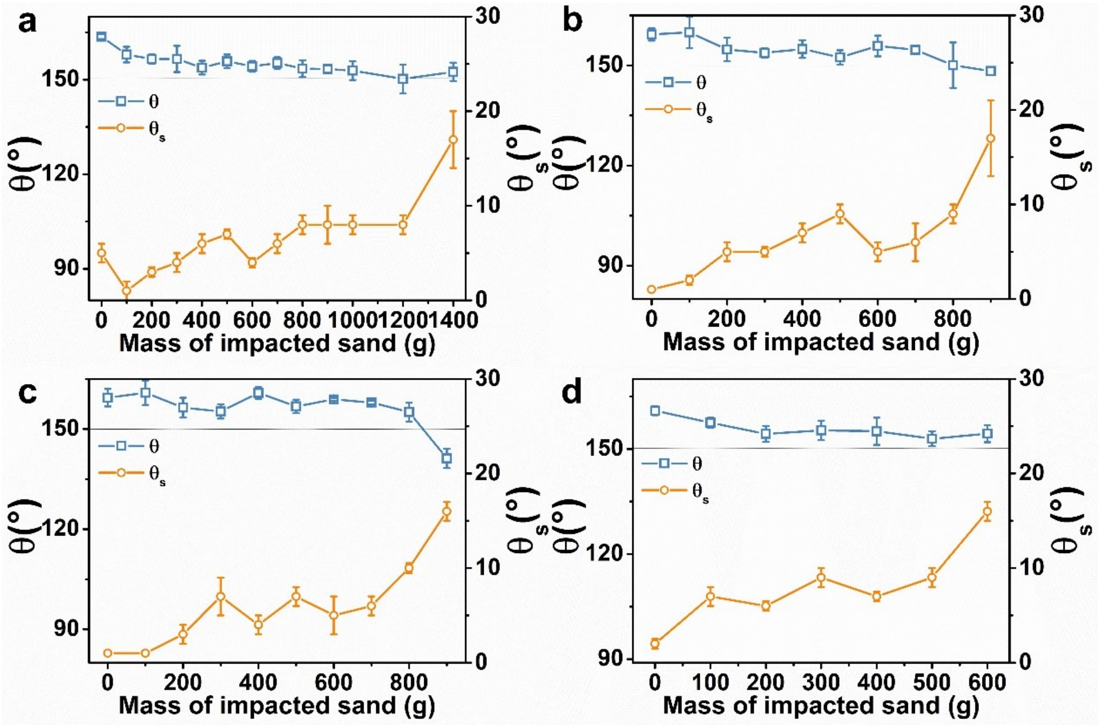

Fig. S5 Sand impact results of sample R-35/NPs-50/P-16 (a), R-35/NPs-50/P-8 (b), R-35/NPs-40/P-16 (c) and R-35/NPs-50/P-16 (d). Clearly, the results are similar to the results of smaples with resin content of 30 wt.% (shown in Fig. 6a) that samples with higher NPs and PTFE content can guarantee a better performance in sand impact.

Table S1 Comparison of the robustness exhibited by our prepared samples with previously reported superhydrophobic sample

Surface	Form	Linear abrasion			Sand impact			Ref
		Pressure/ weight	Sandpaper grit	Cycles /distance	Particle diameter (μm)	Height (cm)	Mass (g)	
PDMS, SiO_2	flexible bulk	20 kPa	P240	50 m				1
PDMS, SiO_2	flexible bulk		360	50 m				2
PA610, modified SiO_2	hard bulk	~1.1 kPa	1000	20 m				3
PTFE, CNT	hard bulk	5.6 kPa	1500	6 m				4
Octadecyl, SiO_2	hard bulk	10.5 kPa	P 100	unidirectional abrasion				5
Mater-Bi®, HDMS + SiO_2	coating	2.1 kPa	Plastic disk (M70)	144 cm				6
ABS, HMFS	coating	20.5 kPa		86.36 m				7
FPU/F-POSS	coating			1000 m				8
CNT, PDA, Al_2O_3, PTFE	coating	150 kPa	1000	1000 cycles				9
SiO_2, PTMS	coating	2 kPa	1200	27				10
SiO_2@TPR-SSM	film	100 g	1000	14				11
SiO_2, Ep, HMDS	coating	100 g	800	20 cycles				12
PDMS, PMMA	film				300	50	50	13
AP, ZnO and PTFE	coating	200 g	1000	5 m	300-600	50	50	14
Graphene, PDMS	coating				50-250	30	50	15
PVA, SiO_2	film				100-350	100	80	16
Ep, PS, SiO_2	coating				300-1000	40	50	17
PS, SiO_2	coating	7.84 kPa	150	45				18

PU, modified SiO_2	coating	9.8 kPa	2000	150				19
PU, SiO_2	coating	300 g	600	35/11.5 m				20
Silicon resin, SiO_2	coating	2.61 kPa	800	0.8 m		50	100	21
Tape, TiO_2	coating	2.45 kPa	240	8 m				22
PU, PAL@M-POS	coating	2.3 kPa	2000	40/1.6 m				23
TiO_2, PDMS	coating				300	50	50	24
PDMS, carbonyl iron particle, SiO_2	film	12.5 kPa	1000	200				25
Ceramic skeleton, PTFE	coating	100g	240	40				26
Poly(ethylene-co-acrylic acid), SiO_2	coating		360	27				27
CNT, PTFE	bulk	5.6 kPa	1500	0.3 m				28
polyester, PTFE	coating	9.6 kPa	220	60				29
PDMS, SiO_2, carbonyl iron particle	film	7.6 kPa		500 cycles				30
PDMS, Ag	film	50 g		4 m				31
PDMS	coating				500	20		32
This work	coating	22.5 kPa	180/600	10 m/12.8 m	355-710	30	1400	

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