Supporting information

In figure S1, the average direct transmittance spectra, before and after different aging tests and cleaning regimes are presented together with the AM1.5 direct solar irradiance [1]. The corresponding solar weighted transmittance (T_{SW}) values are presented in table S1, with standard deviations and percental difference compared to pristine coatings.

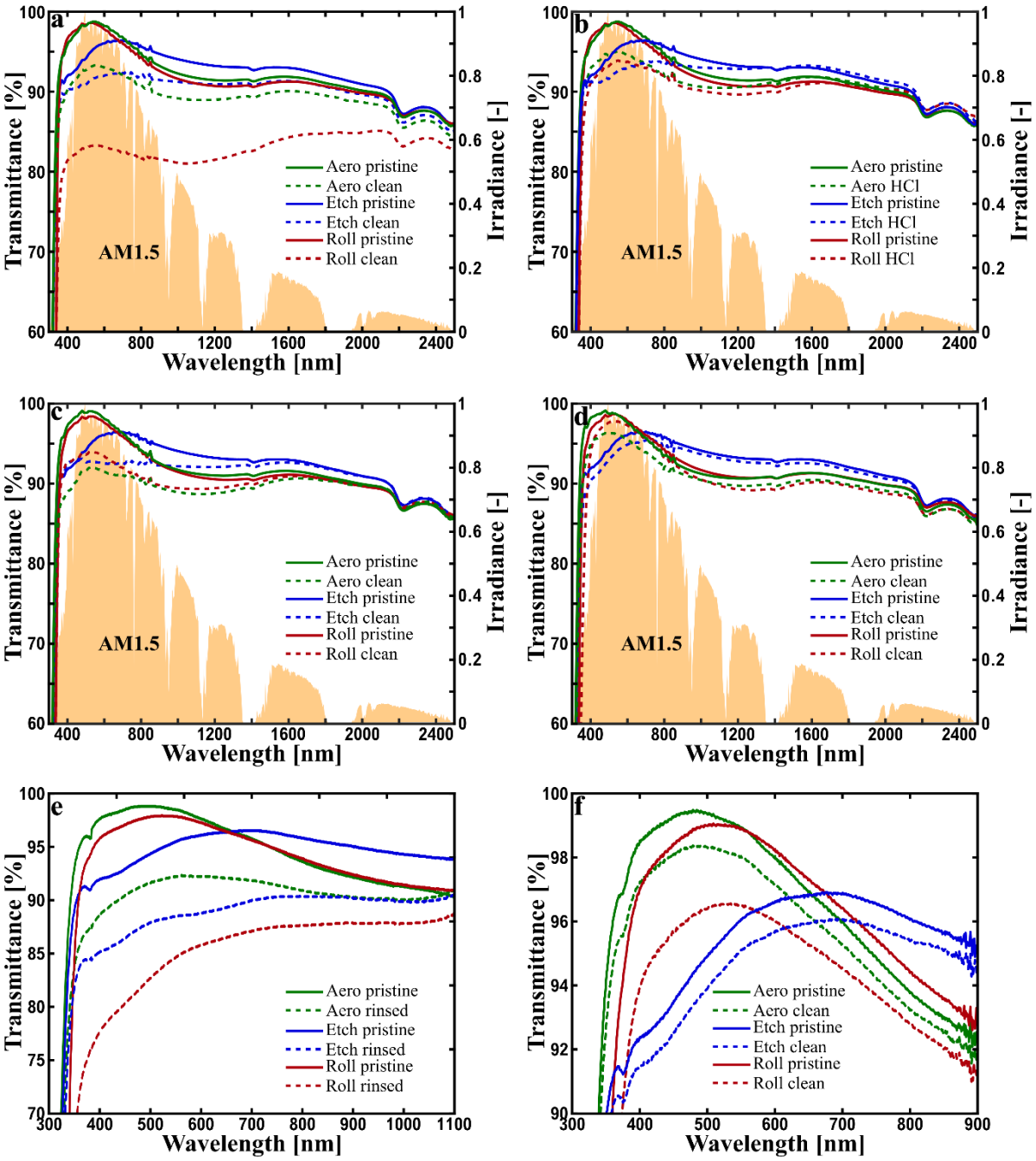

Figure S1. *Average direct transmittance spectra of AR coated low iron glass before and after aging tests and different cleaning regimes, presented with the AM1.5 direct solar spectrum [1]. Specifically, spectra before and after humidity freeze, clean (a) and HCl (b), damp heat (c), outdoor exposure (d), industrial climate chamber test (e) and rinsed after abrasion (f).*

Table S1. *Average T_{SW} before and after different durability tests.*

	Cleaning	AR_{Aero} **[%]**	ΔT_{SW} **[%]**	AR_{Etch} **[%]**	ΔT_{SW} **[%]**	AR_{Roll} **[%]**	ΔT_{SW} **[%]**
HF	Pristine	94.9(2)		94.2(1)		94.3(1)	
	HCl	92.5(2)	-2.6	92.5(3)	-1.8	91.4(1)	-3.0
	Clean	90.8(0)	-4.3	91.2(11)	-3.2	82.0(18)	-13.0
	Dirty	89.0(1)	-6.2	89.6(6)	-4.9	77.4(11)	-17.9
DH	Pristine	94.8(4)		94.2(3)		94.1(1)	
	Clean	90.1(4)	-4.9	92.2(2)	-2.1	91.1(1)	-3.1
	Dirty	89.9(5)	-5.2	91.4(2)	-2.9	90.4(2)	-3.9
CLC	Pristine	95.5(5)		94.9(2)		94.8(8)	
	Clean	90.9(11)	-4.8	88.7(11)	-6.5	84.8(47)	-10.6
	Dirty	90.3(13)	-5.5	85.7(58)	-9.7	83.3(41)	-12.1
Out	Pristine	94.5(0)		94.2(1)		94.3(0)	
	Clean	92.7(5)	-1.9	93.3(5)	-1.0	93.0(0)	-1.4
	Dirty	90.3(10)	-4.5	91.9(5)	-2.5	91.7(0)	-2.8
Abr	Pristine	96.6(1)		95.2(1)		96.1(0)	
	Rinsed	95.8(2)	-0.8	94.3(2)	-1.0	94.8(1)	-1.4

Figure S2 shows selected scratches before and after the industrial climate chamber test on pristine substrate and AR treated surfaces made by a Rockwell tip from 0.03 N up to 30N with linearly increasing load over 5 mm. Below the selected scratches, a typical scratch pattern [2], see figure S2e. The scratch resistance data can be seen in table S2.

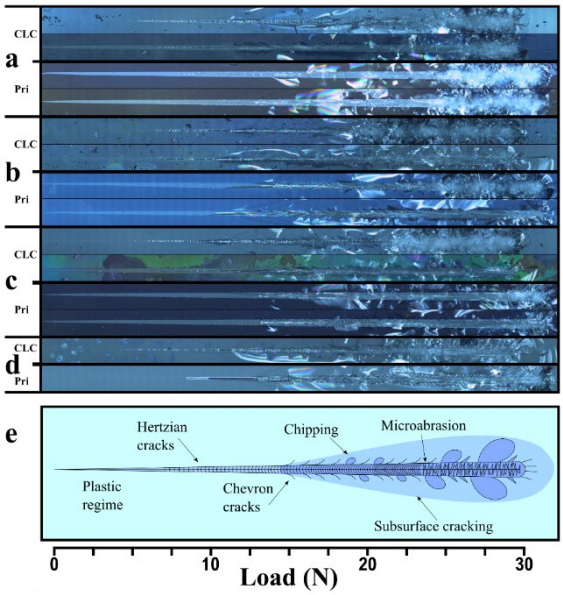

Figure S2. *Scratch resistance before (Pri) and after the industrial climate chamber test (CLC) of AR treated samples, namely AR_{Aero} (a), AR_{Etch} (b) and AR_{Roll} (c),the low iron float glass substrate (d) as well as a schematic of a typical scratch pattern [2] (e).*

Table S2: *Average pooled scratch resistance recorded damage loads for first appearance of typical scratch features based on 5 scratches and two specimens for each sample type.*

	Sample	Hertzian (N)	Chevron (N)	Chipping (N)	Microabrasion (N)
Pristine	FG	13.3(19)	18.4(4)	22.8(14)	24.2(7)
	AR_{Aero}	6.6(7)	19.9(8)	23.5(11)	24.8(9)
	AR_{Etch}	6.6(13)	17.3(17)	26.5(10)	24.2(9)
	AR_{Roll}	5.8(2)	18.4(3)	24.7(5)	27.3(4)
CLC	FG	8.1(11)	17.0(15)	20.8(5)	23.3(7)
	AR_{Aero}	4.9(2)	17.6(5)	21.0(14)	22.1(10)
	AR_{Etch}	5.6(2)	18.4(7)	24.9(10)	23.7(30)
	AR_{Roll}	5.1(4)	16.6(6)	21.6(11)	23.1(9)

The deposits observed primarily on the AR_{Roll} samples after the humidity freeze tests were characterized using EDS mapping and XPS, see figure S3. The deposits visible in the SEM image overlap well with the EDS signals of Ca and C, while Na (and other weaker signals not presented here) does not. In the XPS spectra of O 1s, Ca 2p and C 1s at 531.2, 346.9 and 289.3 eV, respectively, suggest that the observed deposits are $CaCO_3$ [3].

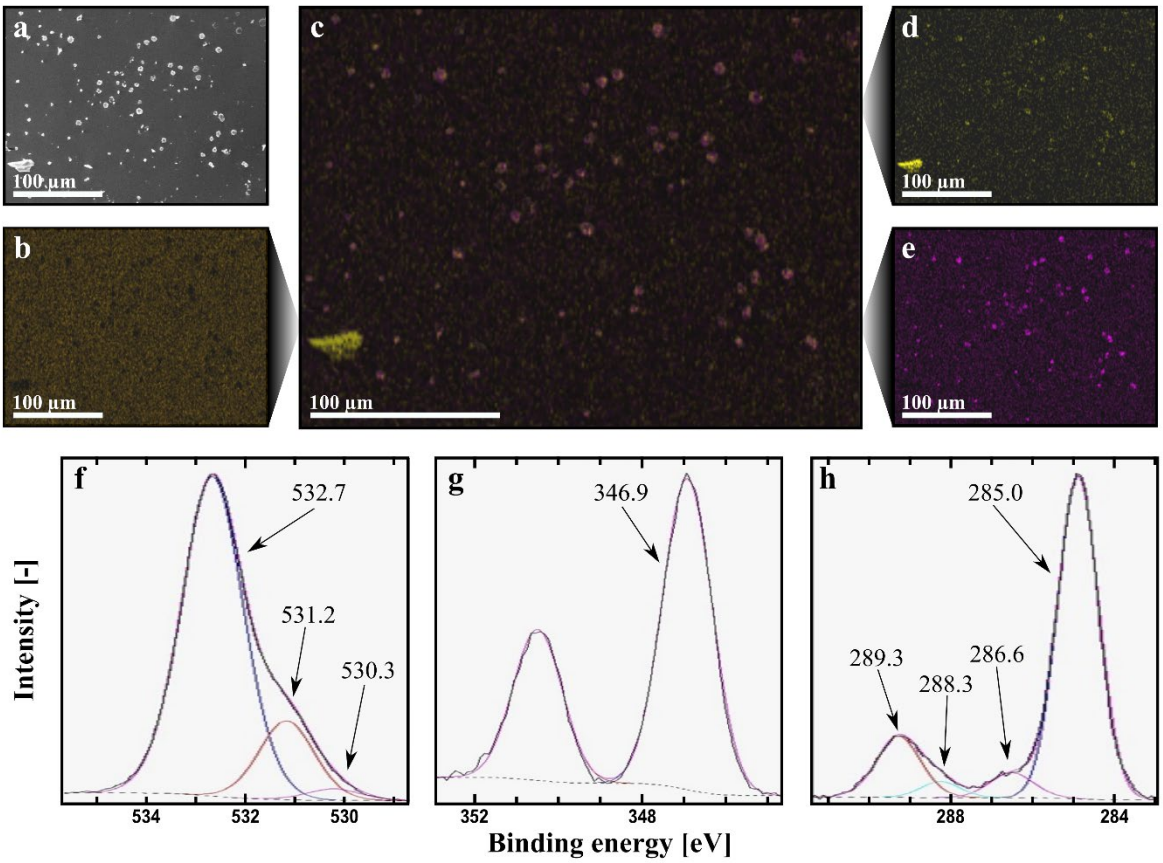

Figure S3. *The deposit on the clean AR_{Roll} sample after humidity freeze is clearly visible in the SEM image (a). The EDS mapping show that the signal intensities of C (d) and Ca (e) align with the image of the visible deposits and each other (c) while Na (b) does not (none of the other weaker signals overlapped either). The XPS spectra of O 1s (f) Ca 2p (g) and C (h) show the peaks associated with $CaCO_3$ at 531.2, 346.9 and 289.3 eV, respectively [3]. Note that both Ca 2p 3/2 and 1/2 are presented.*

The hardness, reduced elastic modulus and corresponding indentation depth of the glass substrate and AR coated glass before and after the industrial climate chamber test is presented in table S3. Correspondingly, the crack resistance before and after the same test is presented in table S4.

Table S3. *Hardness, reduced elastic modulus and indentation depth at max load determined by nanoindentation for 1 mN load with errors given by the pooled standard deviation.*

	Sample	Hardness (GPa)	Reduced elastic modulus (GPa)	Indentation depth (nm)
Pristine	FG	7.9(4)	81(3)	70(2)
	AR_{Aero}	3.3(2)	61(3)	104(3)
	AR_{Etch}	4.2(5)	66(3)	93(3)
	AR_{Roll}	3.5(3)	62 (3)	100(12)
CLC	FG	6.7(6)	77 (3)	76(4)
	AR_{Aero}	4.7(6)	69(4)	93(8)
	AR_{Etch}	3.5(5)	60 (6)	103()
	AR_{Roll}	3.1(7)	59(7)	133(9)

Table S4. *Crack resistance from measurements of two samples with the corresponding Weibull fitting parameters. The error of the crack resistance value is the standard deviation from the two samples and the error of fit is given from the root mean square deviation, see section 2.4.2.*

	Pristine				CLC			
Sample	**CR (N)**	**x_c**	**m**	**RMSQ**	**CR (N)**	**x_c**	**m**	**RMSQ**
FG	0.57(11)	0.56	2.57	7.6	0.97(1)	1.07	3.69	3.3
		0.71	4.15	2.7		1.08	3.22	2.2
AR_{Aero}	0.76(5)	0.88	3.63	3.2	0.35(12)	0.34	1.35	12.8
		0.79	4.40	4.1		0.49	2.72	1.0
AR_{Etch}	1.06(10)	1.24	3.75	2.4	0.32(11)	0.25	11.35	3.2
		1.12	2.97	6.1		0.42	5.78	2.5
AR_{Roll}	1.42(13)	1.42	5.05	6.3	0.91(10)	1.09	3.32	5.7
		1.66	3.77	4.7		0.88	7.21	2.5

References

[1] ASTM Standard G173, Standard Tables for Reference Solar Spectral Irradiances: Direct Normal and Hemispherical on 39° Tilted Surface, ASTM International, 2020.

[2] E. Moayedi and L. Wondraczek, Quantitative analysis of scratch-induced microabrasion on silica glass, *Journal of Non-Crystalline Solids,* vol. 470, pp. 138-144, 2017, https://doi.org/10.1016/j.jnoncrysol.2017.05.003.

[3] T. Roychowdhury *et al.*, Calcite (CaCO3), by near-ambient pressure XPS, *Surface Science Spectra,* vol. 26, no. 1, 2019, https://doi.org/10.1116/1.5109266.