Supplementary Materials: Electrochemical Impedance Spectroscopy Study of Waterborne Epoxies Coatings Film Formation

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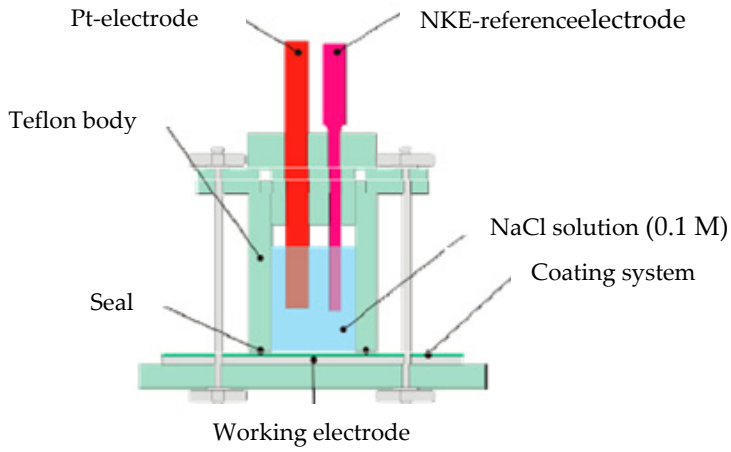
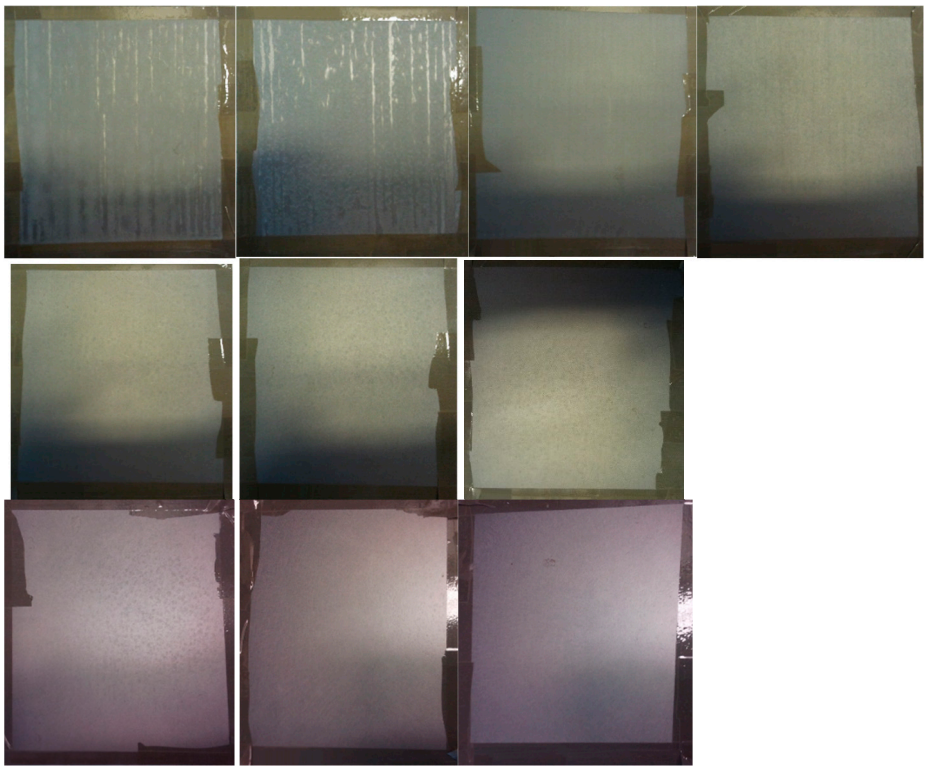
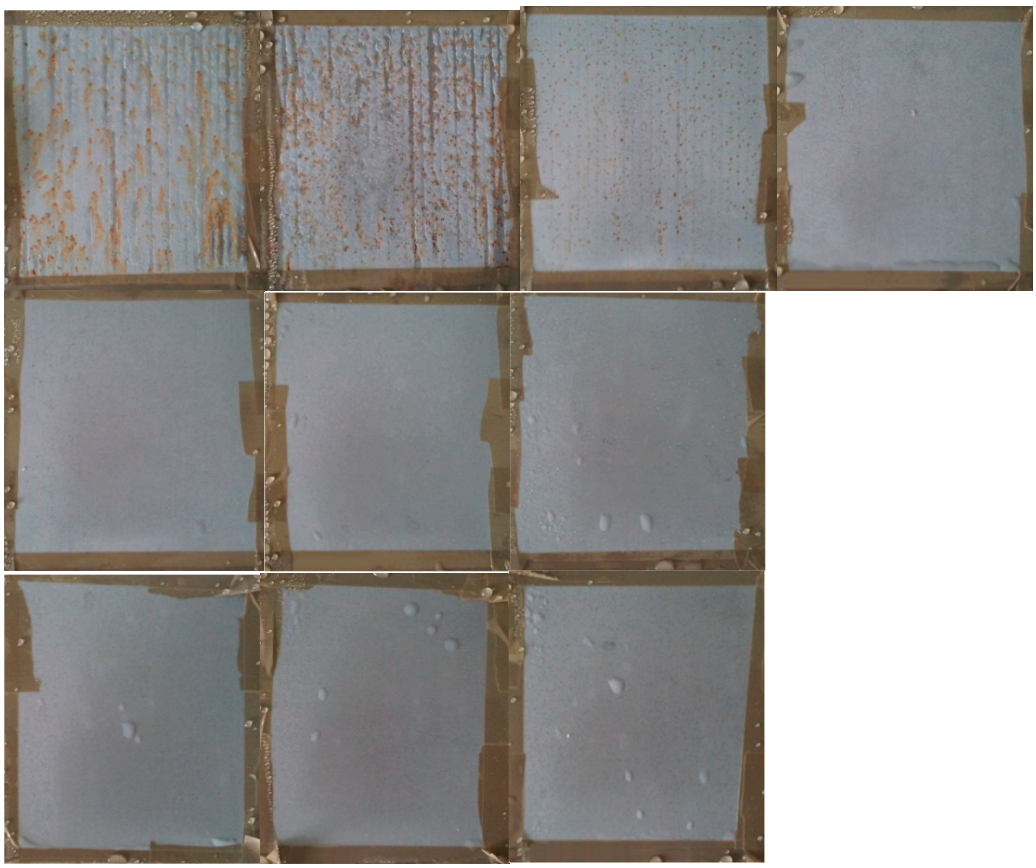


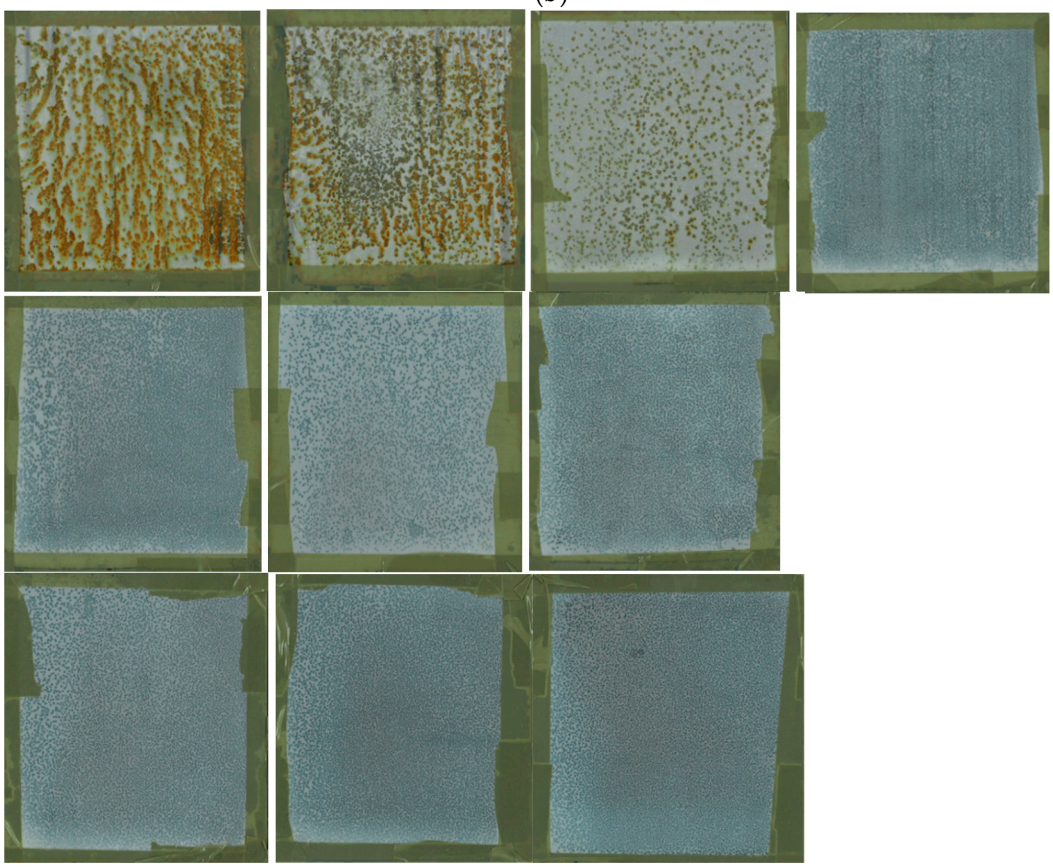
Figure S1. Tait cell for EIS measuring.



(**a**)

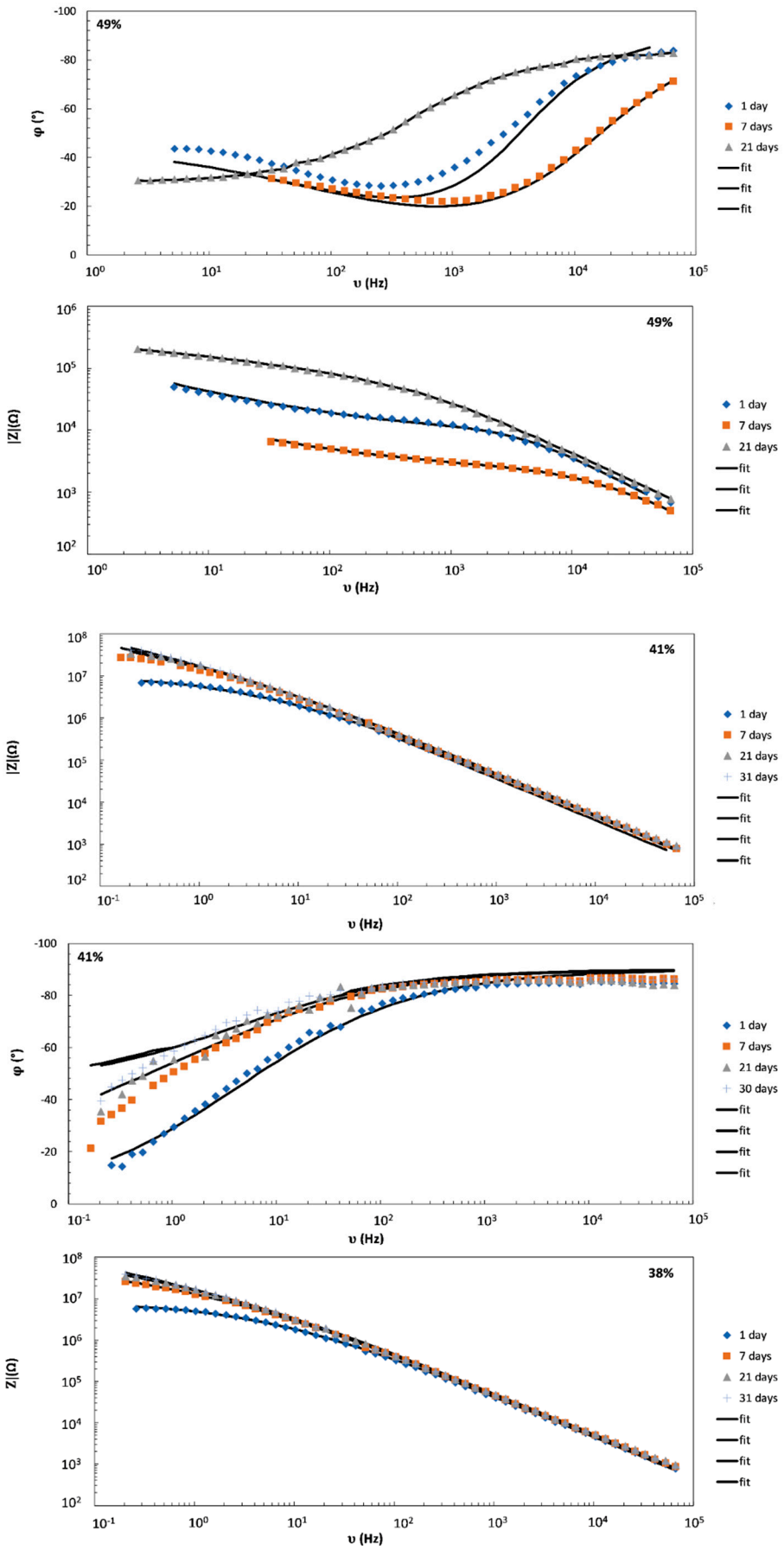


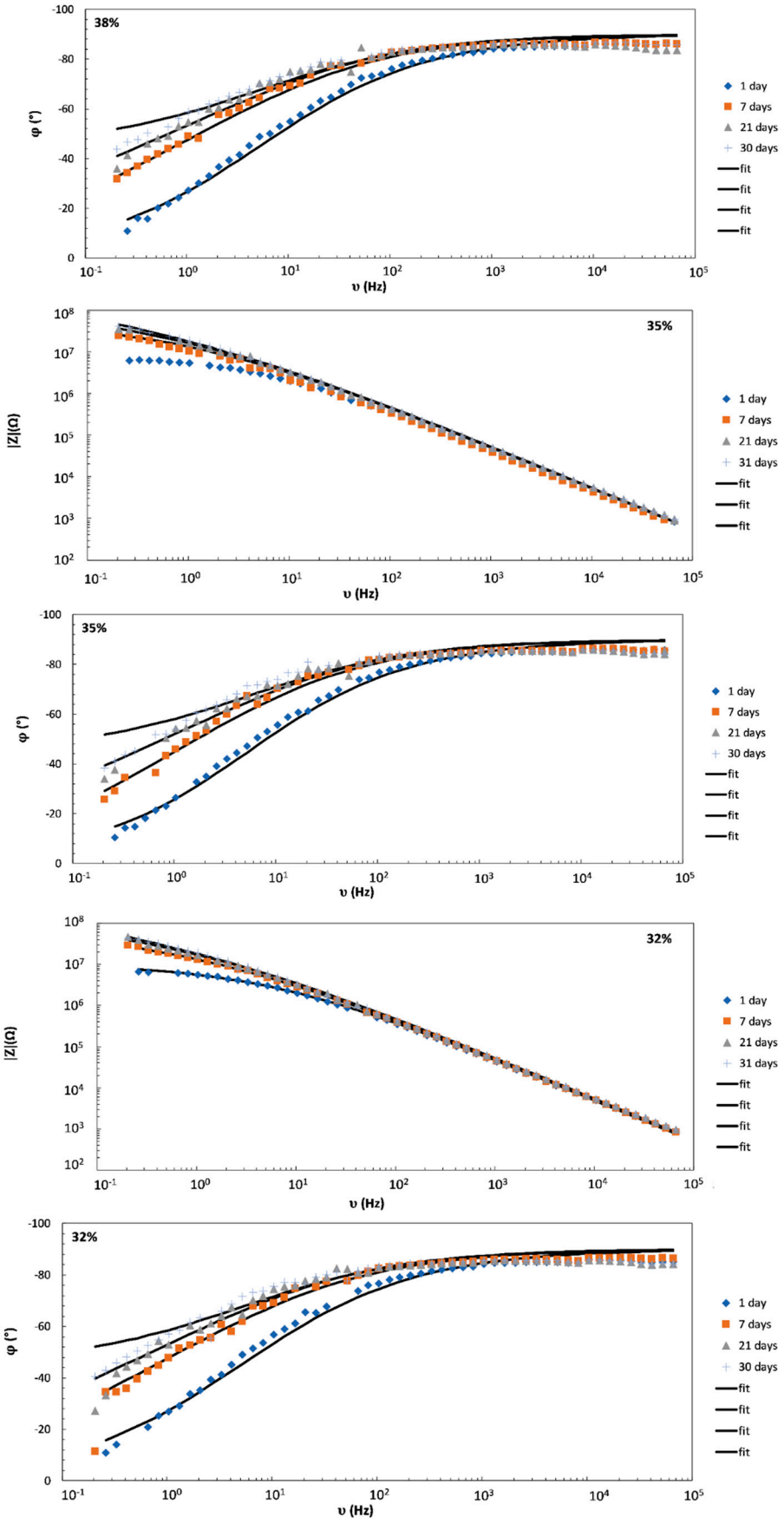
(**b**)

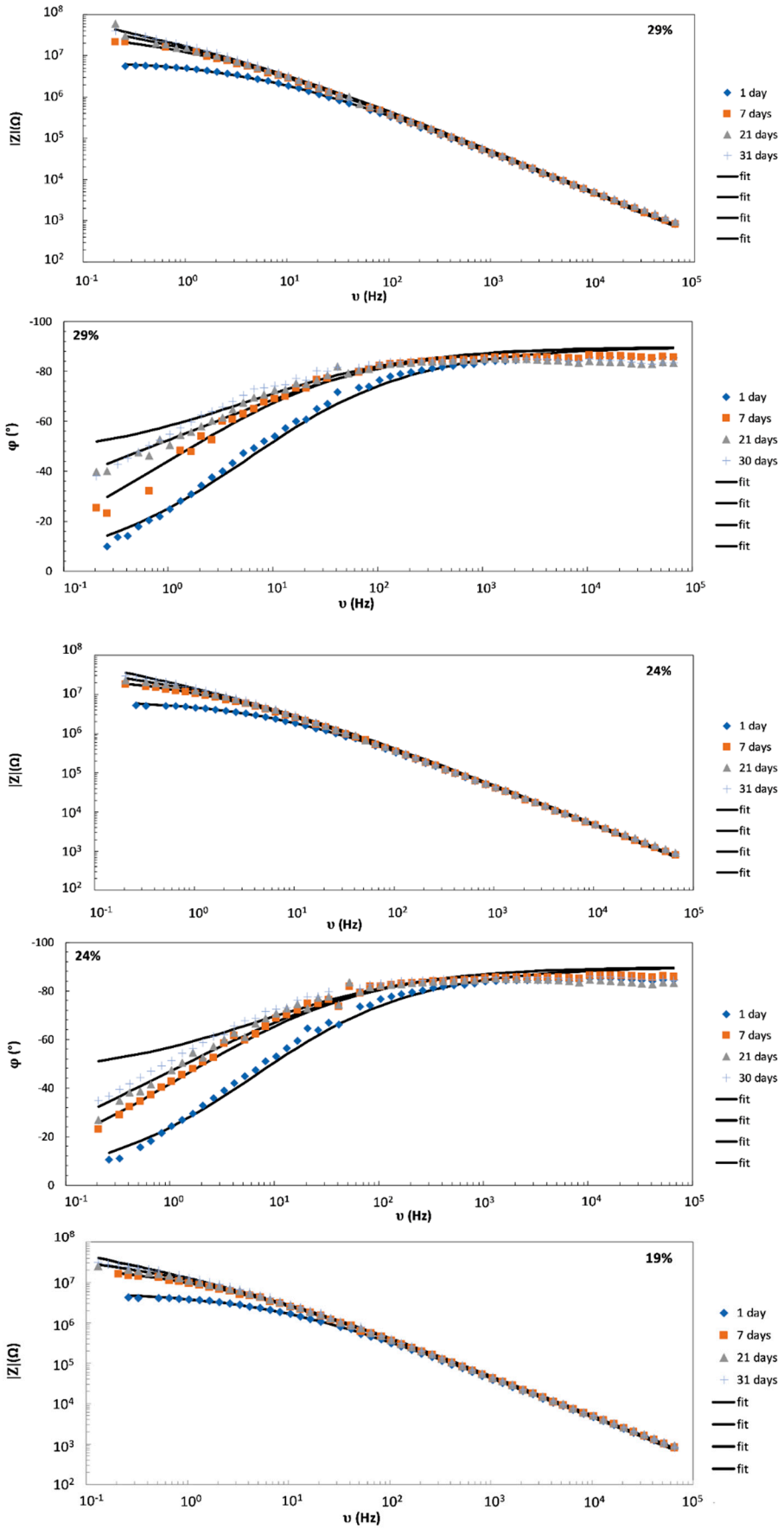


(**c**)

Figure S2. Images of samples surfaces after (**a**) 0 h, (**b**) 24 h, and (**c**) 7 days of water condensation chamber exposures.


49%
φ (°)
υ (Hz)
1 day
7 days
21 days
fit
fit
fit
49%
|Z|(Ω)
υ (Hz)
1 day
7 days
21 days
fit
fit
fit
41%
|Z|(Ω)
υ (Hz)
1 day
7 days
21 days
31 days
fit
fit
fit
fit
41%
φ (°)
υ (Hz)
1 day
7 days
21 days
30 days
fit
fit
fit
fit
38%
Z|(Ω)
υ (Hz)
1 day
7 days
21 days
31 days
fit
fit
fit
fit


38%
φ (°)
υ (Hz)
1 day
7 days
21 days
30 days
fit
fit
fit
fit
35%
|Z|(Ω)
υ (Hz)
1 day
7 days
21 days
31 days
fit
fit
fit
35%
φ (°)
υ (Hz)
1 day
7 days
21 days
30 days
fit
fit
fit
fit
32%
|Z|(Ω)
υ (Hz)
1 day
7 days
21 days
31 days
fit
fit
fit
fit
32%
φ (°)
υ (Hz)
1 day
7 days
21 days
30 days
fit
fit
fit
fit


29%
|Z|(Ω)
υ (Hz)
1 day
7 days
21 days
31 days
fit
fit
fit
fit
29%
φ (°)
υ (Hz)
1 day
7 days
21 days
30 days
fit
fit
fit
fit
24%
|Z|(Ω)
υ (Hz)
1 day
7 days
21 days
31 days
fit
fit
fit
fit
24%
φ (°)
υ (Hz)
1 day
7 days
21 days
30 days
fit
fit
fit
fit
19%
|Z|(Ω)
υ (Hz)
1 day
7 days
21 days
31 days
fit
fit
fit
fit

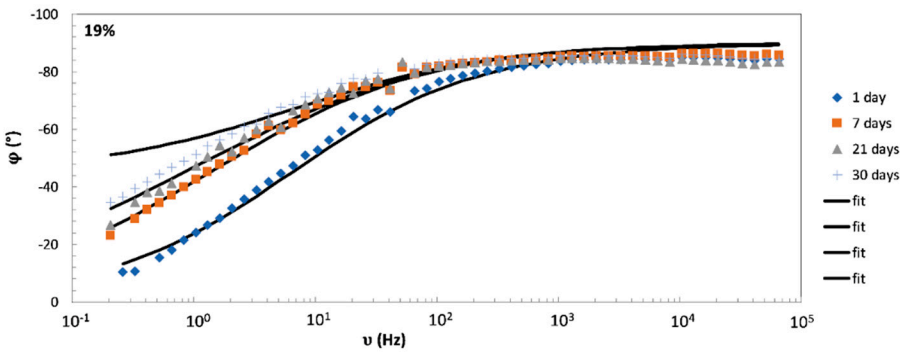


Figure S3. Impedance spectra of representative samples WB EP-talc coatings series with different PVC in the complex plane and Bode diagrams.

Table S1. Coating capacitance of the samples versus annealing time.

Coating Capacity, C_c (10^{-9} F)										
Time (h)	**PVC = 50%**	**±**	**PVC = 49%**	**±**	**PVC = 46%**	**±**	**PVC = 41%**	**±**	**PVC = 38%**	**±**
24	3.788	0.04	3.923	0.04	3.233	0.01	3.380	0.01	3.393	0.008
168	3.900	0.02	2.308	0.07	3.079	0.01	3.473	0.008	3.170	0.008
504	3.788	0.04	–	–	2.971	0.01	3.184	0.01	3.007	0.01
720	3.081	0.02	–	–	3.320	0.01	3.385	0.009	3.112	0.008
Time (h)	**PVC = 35%**	**±**	**PVC = 32%**	**±**	**PVC = 29%**	**±**	**PVC = 24%**	**±**	**PVC = 19%**	**±**
24	3.219	0.009	3.076	0.01	3.330	0.009	3.217	0.01	3.307	0.01
168	2.976	0.01	3.155	0.008	3.324	0.009	3.399	0.008	3.230	0.009
504	2.905	0.01	2.938	0.01	3.045	0.01	3.117	0.01	3.076	0.01
720	2.902	0.01	2.895	0.01	3.033	0.01	3.200	0.01	3.061	0.02

Table S2. Coefficients of the Warburg element of the samples versus annealing time.

Waburg Coefficient, σ_c (10^{-8} S rad $^{-1/2}$ s$^{1/2}$)										
Time (h)	**PVC = 50%**	**±**	**PVC = 49%**	**±**	**PVC = 46%**	**±**	**PVC = 41%**	**±**	**PVC = 38%**	**±**
24	14.434	0.4	55.90	0.08	5.294	0.03	3.71	0.02	3.915	0.02
168	67.074	0.06	1048.70	0.01	2.211	0.03	1.98	0.02	2.051	0.02
504	14.434	0.4	–	–	2.254	0.03	1.74	0.03	1.708	0.03
720	27.799	0.06	–	–	1.917	0.03	1.65	0.02	1.782	0.02
Time (h)	**PVC = 35%**	**±**	**PVC = 32%**	**±**	**PVC = 29%**	**±**	**PVC = 24%**	**±**	**PVC = 19%**	**±**
24	3.497	0.02	3.50	0.02	3.744	0.02	3.70	0.03	4.274	0.03
168	1.939	0.03	2.02	0.02	1.991	0.03	2.28	0.02	2.582	0.02
504	1.732	0.03	1.59	0.03	1.980	0.03	2.10	0.03	2.431	0.02
720	1.715	0.02	1.65	0.02	1.764	0.03	2.14	0.02	2.524	0.02

Table S3. Pore resistance of the samples versus annealing time.

Pore Resistance, R_{po} × 10^6 (Ωcm^2)										
Time (h)	**PVC = 50%**	**±**	**PVC = 49%**	**±**	**PVC = 46%**	**±**	**PVC = 41%**	**±**	**PVC = 38%**	**±**
24	0.011	0.0	0.01	0.03	4.963	0.1	10.87	0.03	8.921	0.03
168	0.003	0.01	0.00	0.00	55.011	0.09	64.03	0.06	64.836	0.06
504	0.011	0.0	–	–	64.216	0.1	163.27	0.2	151.850	0.2
720	0.107	0.08	–	–	48.996	0.07	–	–	–	–
Time (h)	**PVC = 35%**	**±**	**PVC = 32%**	**±**	**PVC = 29%**	**±**	**PVC = 24%**	**±**	**PVC = 19%**	**±**
24	9.174	0.03	10.21	0.03	8.321	0.03	7.70	0.03	5.936	0.03
168	52.051	0.07	65.39	0.07	43.590	0.08	34.62	0.05	30.688	0.04
504	129.280	0.2	138.98	0.16	150.940	0.2	61.88	0.1	60.992	0.08

Thickness independent parameters as function of PVC and film formation time

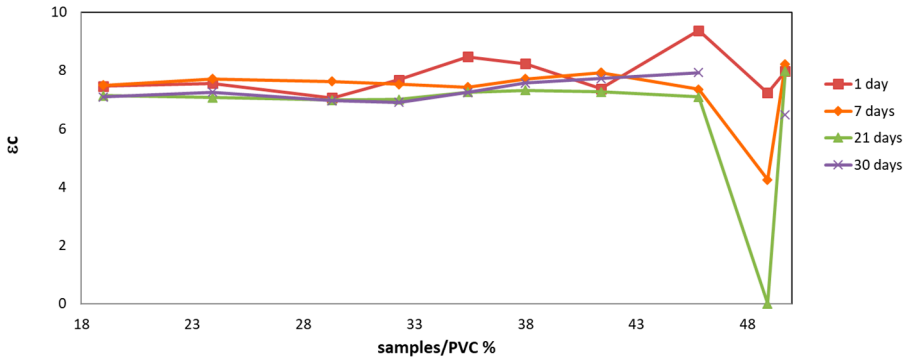


Figure S4. Relative dielectric constant vs. different PVC of the representative samples WB talc coatings.

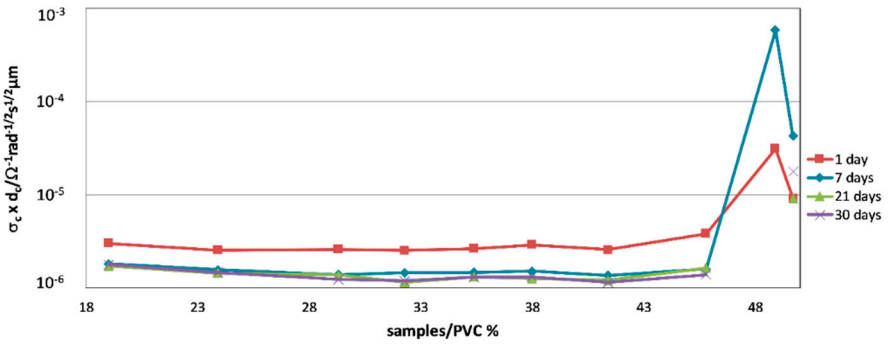


Figure S5. The product of Warburg coefficient with film thickness vs different PVC of the representative samples WB talc coatings.

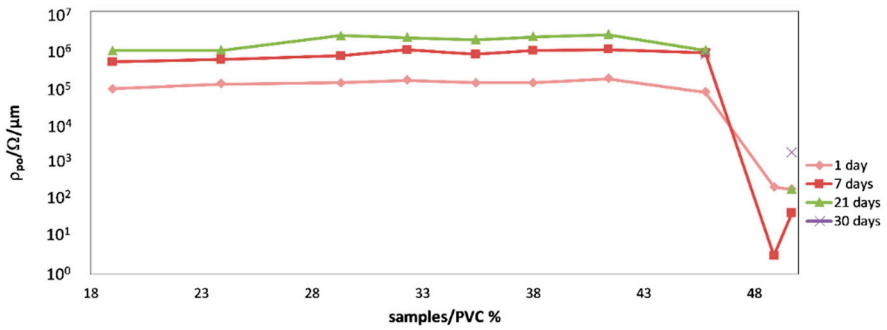


Figure S6. Specific resistance of pores vs. different PVC of the representative samples WB talc coatings.

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