

Supplementary Information

Chemical and mechanical characterization of unprecedented transparent epoxy-nan mica-composites. New model insights for mechanical properties

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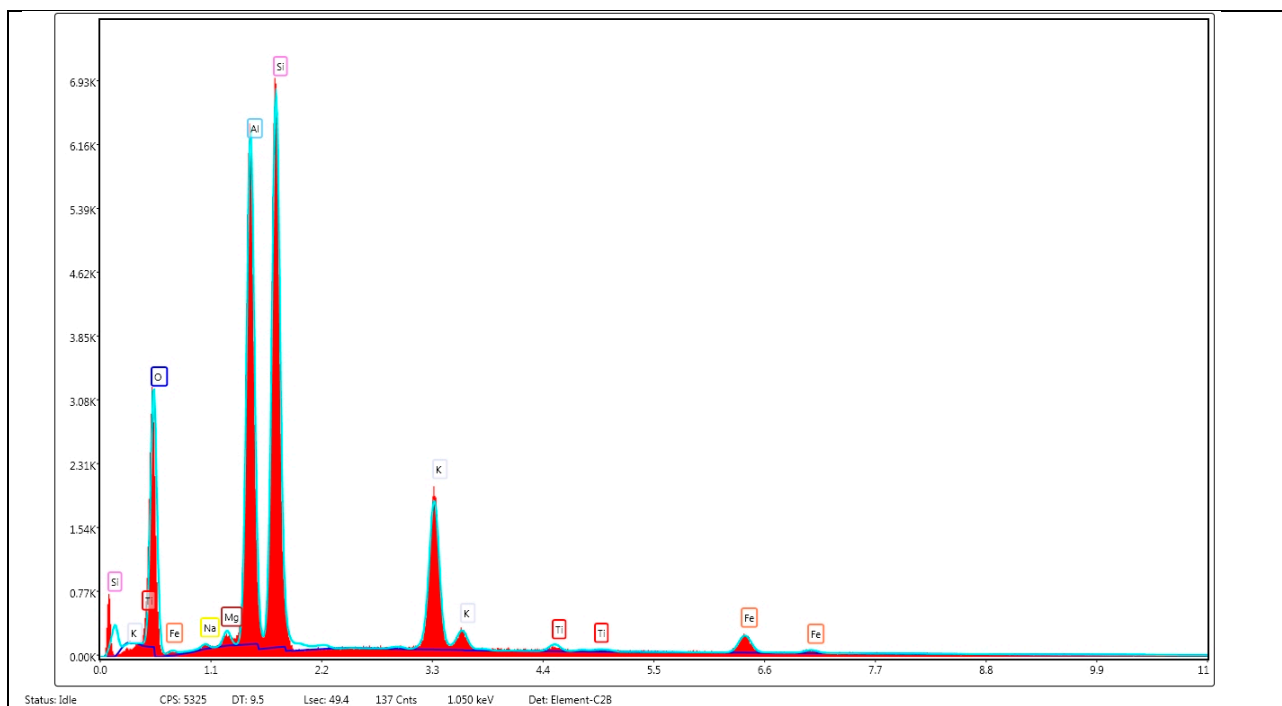
Table S1: Mineralogical composition of micas from XRD data

Minerals (% wt)	Mica 10	Mica 45
Quartz	13,1	9,9
Muscovite	62,7	45,1
Albite	4,1	3,4
Kaolinite	14,2	33,0
Microcline	5,9	8,6

Table S2:

(a) Composition of Mica 10 by XRF data

Element	Weight %	Atomic %
O	46,74	61,93
Na	0,48	0,44
Mg	0,72	0,69
Al	17,47	13,72
Si	24,57	18,55
K	7,63	4,13
Ti	0,6	0,26
Fe	2,52	0,95



(b) Composition of Mica 45 from XRF data

Element	Weight %	Atomic %
Oxygen	47,31	62,09
Na	0,33	0,3
Mg	0,54	0,47
Al	18,7	14,55
Si	24,41	18,25
K	6,48	3,48
Ti	0,46	0,2
Fe	1,78	0,67

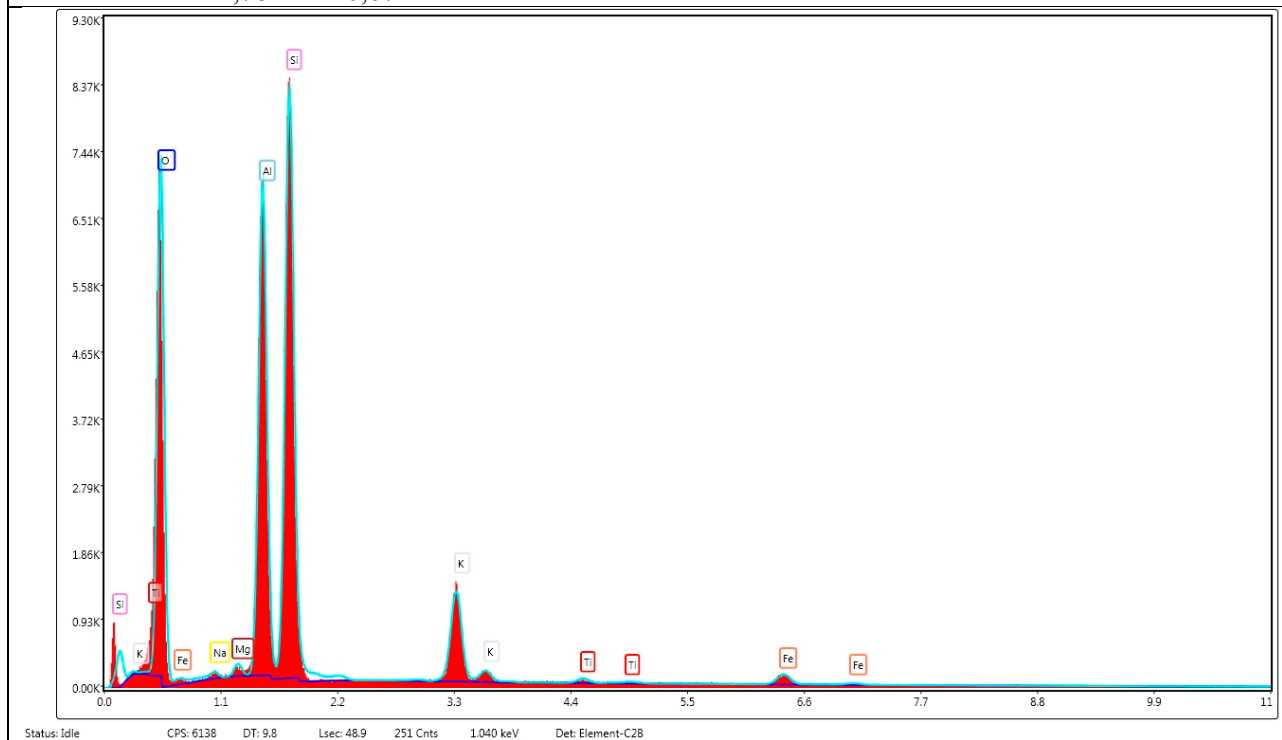


Table S3: Values of the average transmittance for the tested nanocomposites

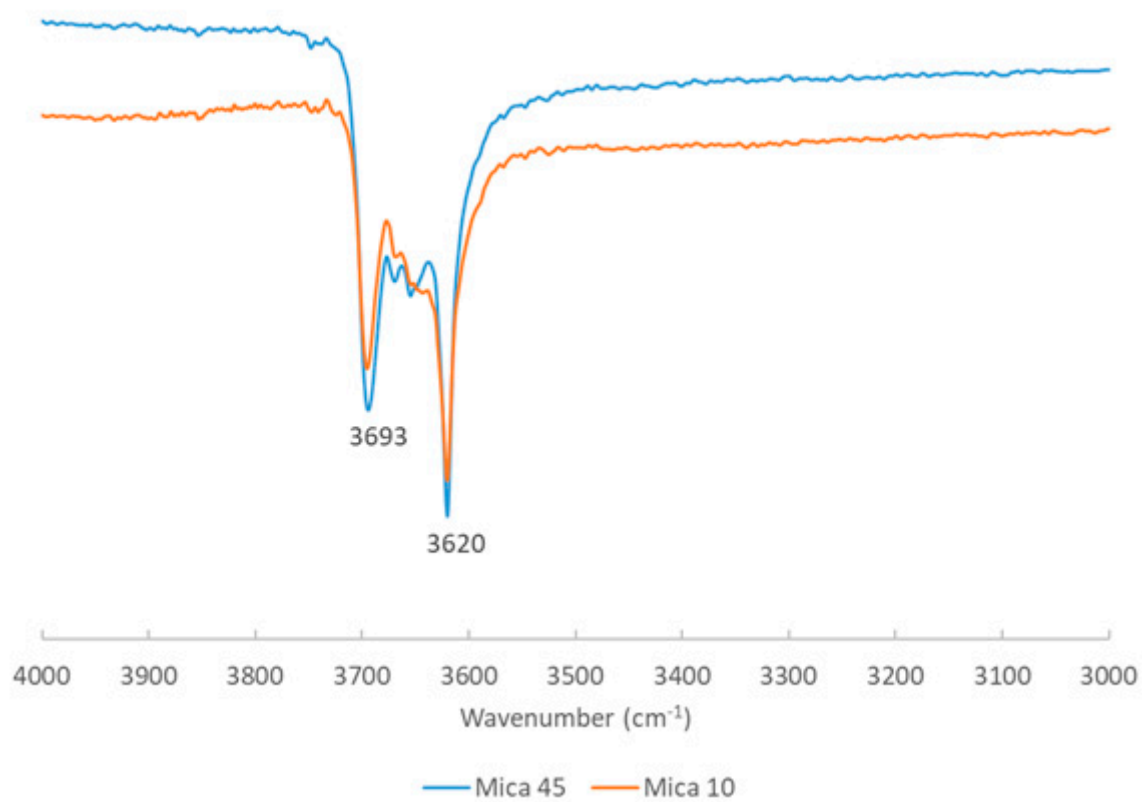
	Mica amount (g) (%wt/wt)	Sample labeling	T (%)
Neat			82
Mica 10	1.6 g (1%)	EM10-1	77
	4.8 g (3%)	EM10-3	75
	8.0 g (5%)	EM10-5	50
Mica 45	1.6 g (1%)	EM45-1	82
	4.8 g (3%)	EM45-3	73
	8.0 g (5%)	EM45-5	70

The reported data are the average of two measurements collected under the same conditions.

The data can be compared with those reported in Huang, J; Nie, X. A simple and novel method to design flexible and transparent epoxy resin with tunable mechanical properties. *Polym. Int.* **2016**, *65*, 835-840.

Figure S1: FT IR spectra of Mica 10 and Mica 45

(a) in the 3000-4000 cm^{-1} region



(b) and in 600-1250 cm^{-1} region

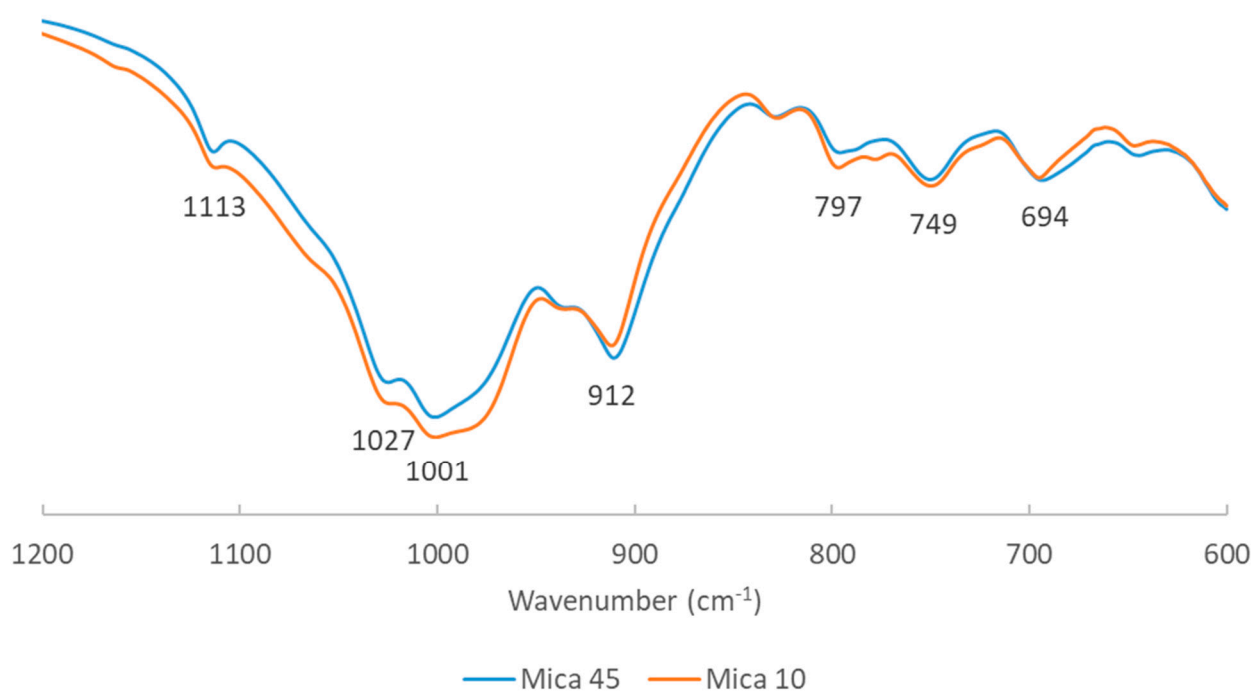


Figure S2: ^{13}C Solid state NMR spectrum of Mica 45

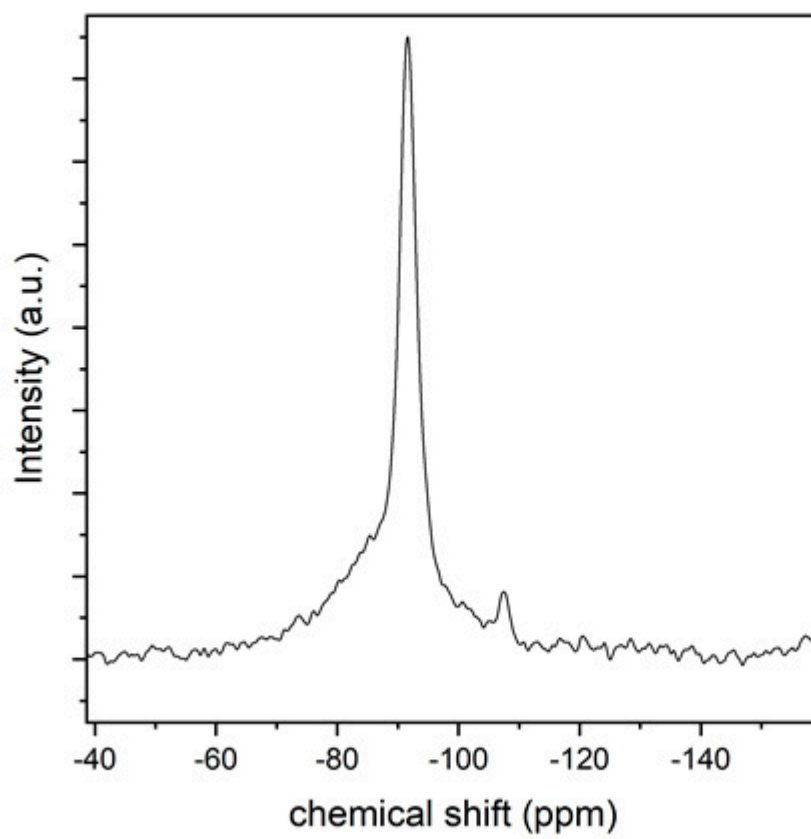


Figure S3: Particle size distribution of Mica 10 and Mica 45 powders



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Result Analysis Report

Sample Name:
MICA 10 - Average

Sample Source & type:

Sample bulk lot ref:

SOP Name:

Measured by:
laboratorio

Result Source:
Averaged

Measured:
venerdì 14 ottobre 2022 08:46:39

Analysed:
venerdì 14 ottobre 2022 08:46:40

Particle Name:
Silica 0.1

Particle RI:
1.544

Dispersant Name:
Ethanol

Accessory Name:
Hydro 2000SM (A)

Absorption:
0.1

Dispersant RI:
1.360

Analysis model:
Multiple narrow modes

Size range:
0.020 to 2000.0... μm

Weighted Residual:
0.996 %

Sensitivity:
Enhanced

Obscuration:
14.50 %

Result Emulation:
Off

Concentration:
0.0117 %Vol

Span :
1.604

Uniformity:
0.506

Result units:
Volume

Specific Surface Area:
1.2 m^2/g

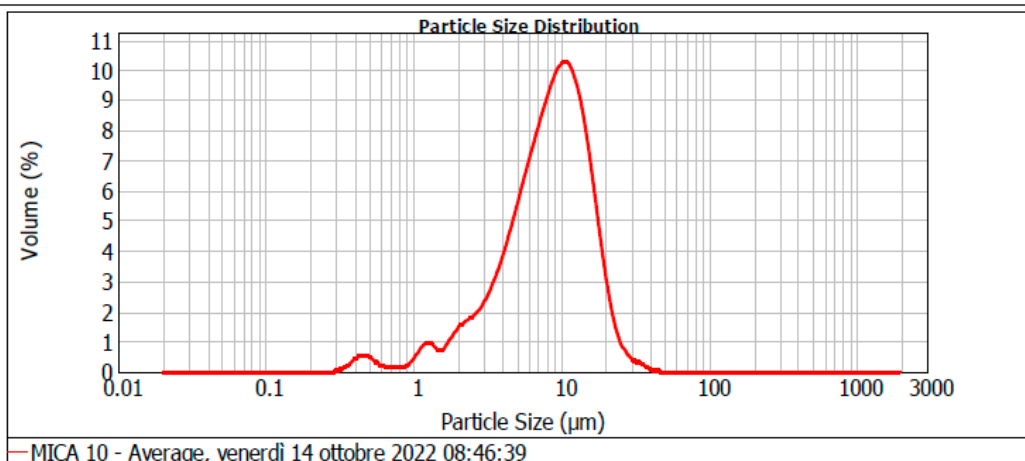
Surface Weighted Mean D[3,2]:
4.984 μm

Vol. Weighted Mean D[4,3]:
9.304 μm

d(0.1): 2.823 μm

d(0.5): 8.539 μm

d(0.9): 16.521 μm



Size (μm)	Volume In %	Size (μm)	Volume In %	Size (μm)	Volume In %	Size (μm)	Volume In %	Size (μm)	Volume In %	Size (μm)	Volume In %
0.010	0.00	0.105	0.00	1.098	0.79	11.482	8.83	120.226	0.00	1258.925	0.00
0.011	0.00	0.120	0.00	1.259	0.80	13.183	7.67	138.038	0.00	1445.440	0.00
0.013	0.00	0.138	0.00	1.445	0.63	15.136	5.94	158.489	0.00	1659.587	0.00
0.015	0.00	0.158	0.00	1.660	0.96	17.378	3.92	181.970	0.00	1905.461	0.00
0.017	0.00	0.182	0.00	1.905	1.33	19.853	2.18	208.930	0.00	2187.762	0.00
0.020	0.00	0.209	0.00	2.188	1.56	22.909	1.03	239.883	0.00	2511.886	0.00
0.023	0.00	0.240	0.00	2.512	1.80	26.303	0.47	275.423	0.00	2884.032	0.00
0.026	0.00	0.275	0.02	2.884	2.22	30.200	0.28	316.228	0.00	3311.311	0.00
0.030	0.00	0.316	0.14	3.311	2.83	34.674	0.14	363.078	0.00	3801.894	0.00
0.035	0.00	0.363	0.33	3.802	3.60	39.811	0.02	416.869	0.00	4365.158	0.00
0.040	0.00	0.417	0.49	4.365	4.53	45.709	0.00	478.630	0.00	5011.872	0.00
0.046	0.00	0.479	0.41	5.012	5.51	52.481	0.00	549.541	0.00	5754.399	0.00
0.052	0.00	0.550	0.20	5.754	6.50	60.256	0.00	630.957	0.00	6606.934	0.00
0.060	0.00	0.631	0.13	6.607	7.43	69.183	0.00	724.436	0.00	7585.776	0.00
0.069	0.00	0.724	0.11	7.586	8.31	79.433	0.00	831.764	0.00	8709.636	0.00
0.079	0.00	0.832	0.17	8.710	9.00	91.201	0.00	954.993	0.00	10000.000	0.00
0.091	0.00	0.955	0.44	10.000	9.26	104.713	0.00	1096.478	0.00		
0.105	0.00	1.098		11.482		120.226		1258.925			



MASTERSIZER



Result Analysis Report

Sample Name:
MICA 145 - Average

SOP Name:

Measured:
venerdì 14 ottobre 2022 08:58:38

Sample Source & type:

Measured by:
laboratorio

Analysed:
venerdì 14 ottobre 2022 08:58:39

Sample bulk lot ref:

Result Source:
Averaged

Particle Name:
Silica 0.1

Accessory Name:
Hydro 2000SM (A)

Analysis model:
Multiple narrow modes

Sensitivity:
Enhanced

Particle RI:
1.544

Absorption:
0.1

Size range:
0.020 to 2000.0... μm

Obscuration:
15.69 %

Dispersant Name:
Ethanol

Dispersant RI:
1.360

Weighted Residual:
0.630 %

Result Emulation:
Off

Concentration:
0.0268 %Vol

Span :
1.938

Uniformity:
0.621

Result units:
Volume

Specific Surface Area:
0.51 m^2/g

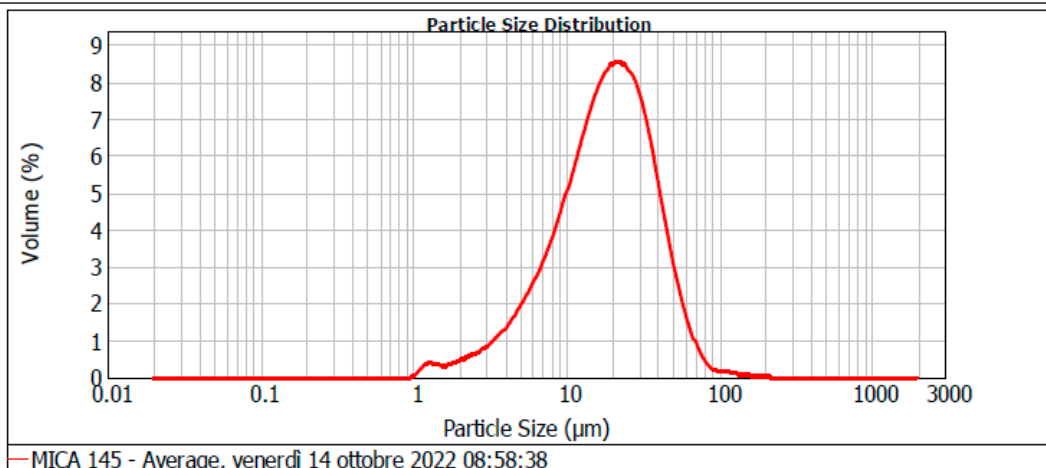
Surface Weighted Mean D[3,2]:
11.776 μm

Vol. Weighted Mean D[4,3]:
22.185 μm

d(0.1): 5.963 μm

d(0.5): 18.616 μm

d(0.9): 42.049 μm



Size (μm)	Volume In %	Size (μm)	Volume In %	Size (μm)	Volume In %	Size (μm)	Volume In %	Size (μm)	Volume In %	Size (μm)	Volume In %
0.010	0.00	0.106	0.00	1.098	0.30	11.482	5.70	120.226	0.10	1258.925	0.00
0.011	0.00	0.120	0.00	1.259	0.34	13.183	6.48	138.038	0.06	1445.440	0.00
0.013	0.00	0.138	0.00	1.445	0.29	15.136	7.11	158.489	0.04	1659.587	0.00
0.015	0.00	0.158	0.00	1.660	0.34	17.378	7.53	181.970	0.03	1905.461	0.00
0.017	0.00	0.182	0.00	1.905	0.43	19.953	7.71	208.930	0.00	2187.762	0.00
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0.040	0.00	0.417	0.00	4.365	1.58	45.709	2.99	478.630	0.00	5011.872	0.00
0.046	0.00	0.479	0.00	5.012	1.95	52.481	2.01	549.541	0.00	5754.399	0.00
0.052	0.00	0.550	0.00	5.754	2.36	60.256	1.22	630.957	0.00	6606.934	0.00
0.060	0.00	0.631	0.00	6.607	2.83	69.183	0.83	724.436	0.00	7585.776	0.00
0.069	0.00	0.724	0.00	7.586	3.40	79.433	0.28	831.764	0.00	8709.636	0.00
0.079	0.00	0.832	0.00	8.710	4.09	91.201	0.16	954.993	0.00	10000.000	0.00
0.091	0.00	0.956	0.05	10.000	4.89	104.713	0.14	1096.478	0.00		
0.105	0.00	1.096		11.482		120.226		1258.925	0.00		

Figure S4: ESEM images at different magnification of the neat epoxy resin and the EM composites

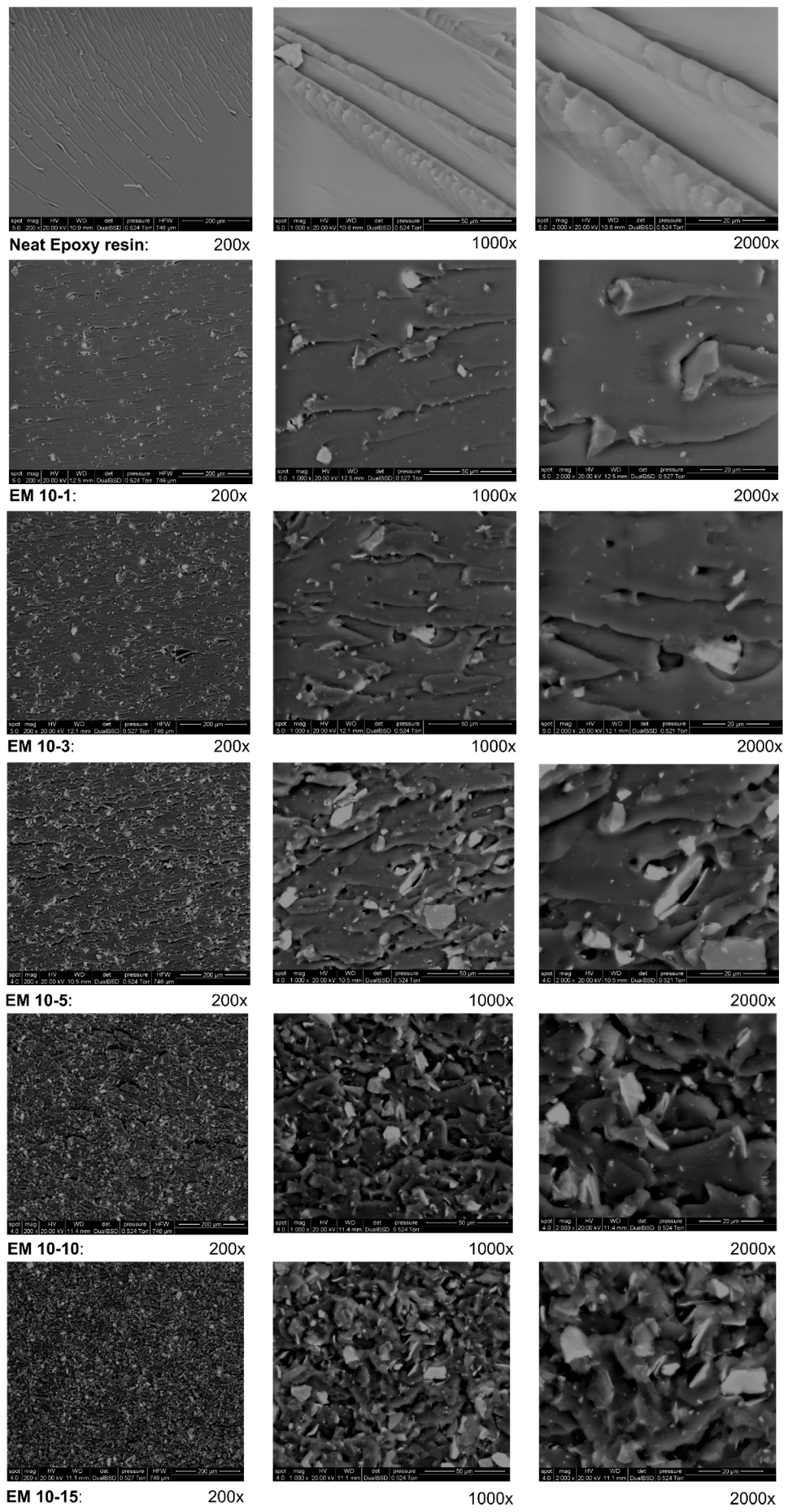


Figure S5: T_{onset} decomposition as function of nominal filler weight percentages for Mica 10 and Mica 45 nanocomposites

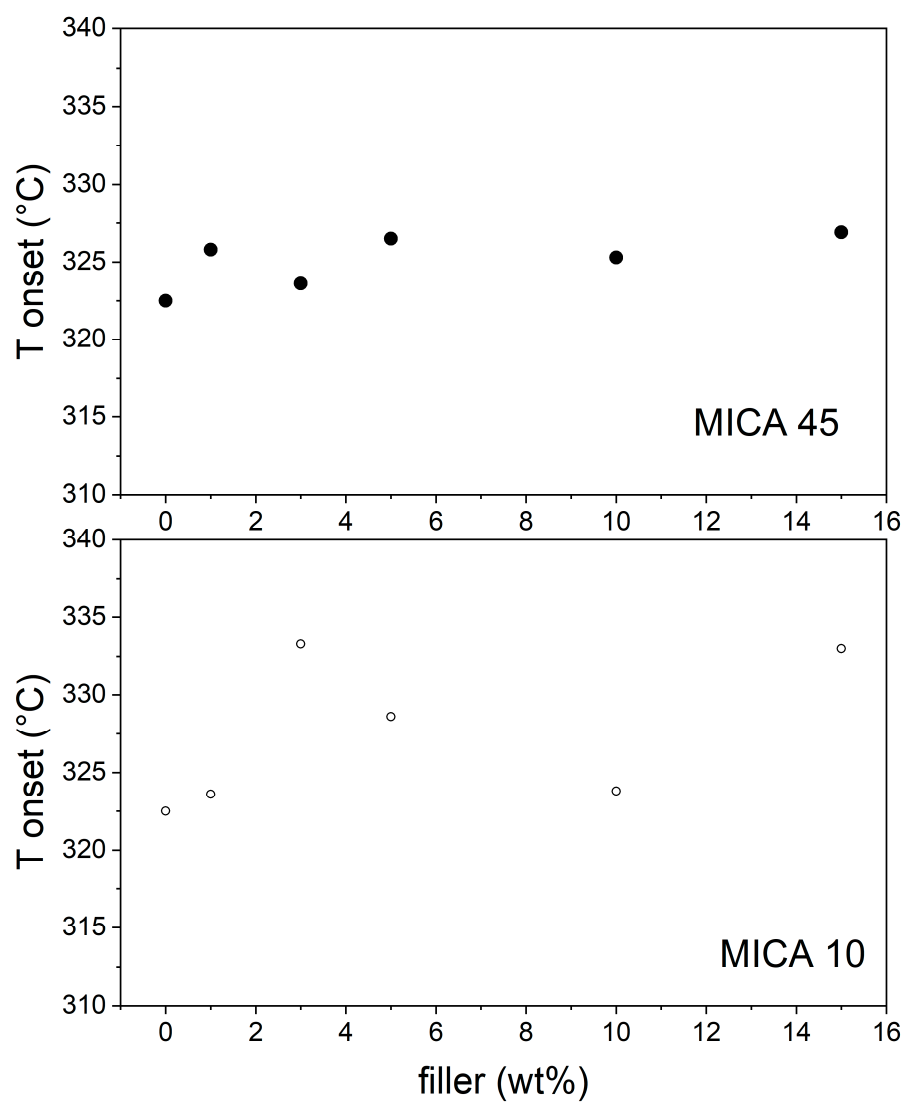


Figure S6: Residual mass (calculated from dry mass) at 700°C as function of nominal filler weight percentages for Mica 10 (void circles) and Mica 45 (full circles) nanocomposites

