

Supporting Information for *Method Development and Analysis of Nanoparticle Size Fraction from Tire-Wear Emissions*

Figures S1-S8

Tables S1 and S2

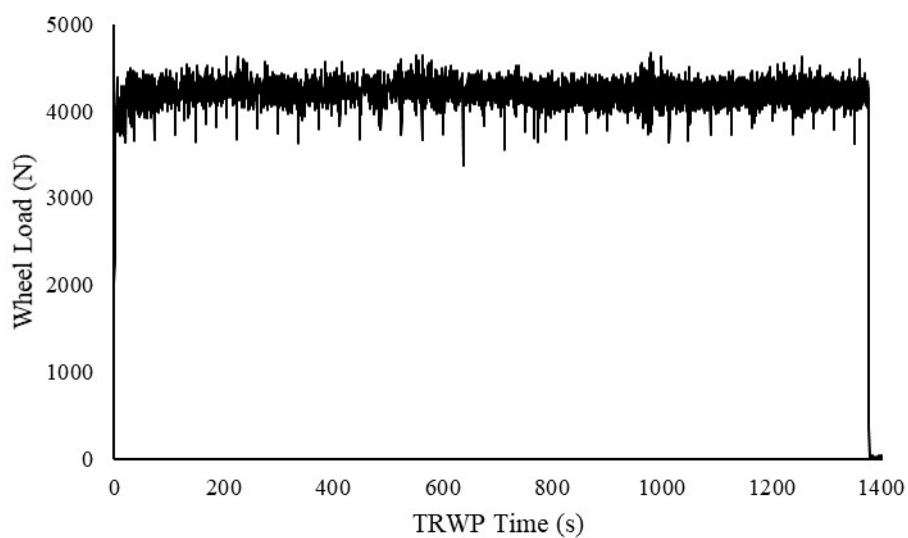


Figure S1. Wheel load force (N) shown against the TRWP time.

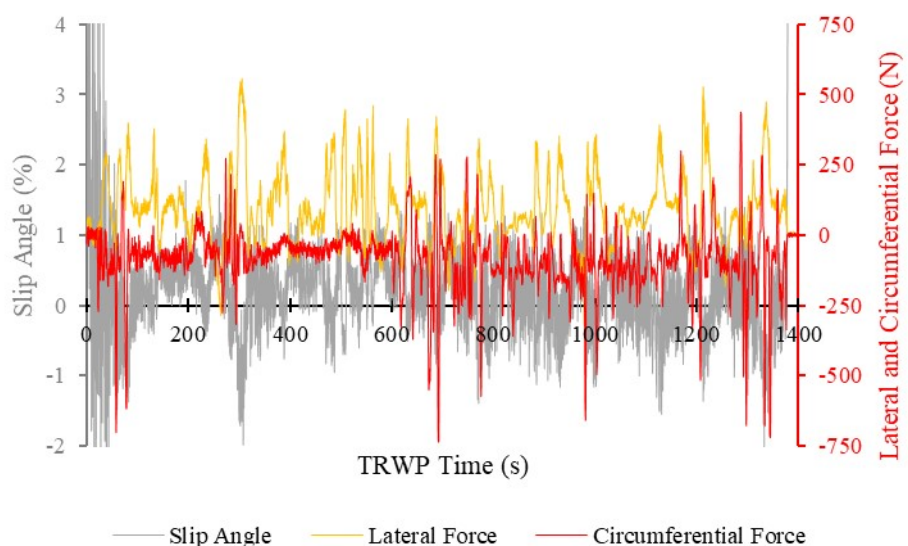


Figure S2. Slip angle (grey, left axis), lateral (yellow) and circumferential (red) forces (right axis) are shown for the tested TRWP cycle.

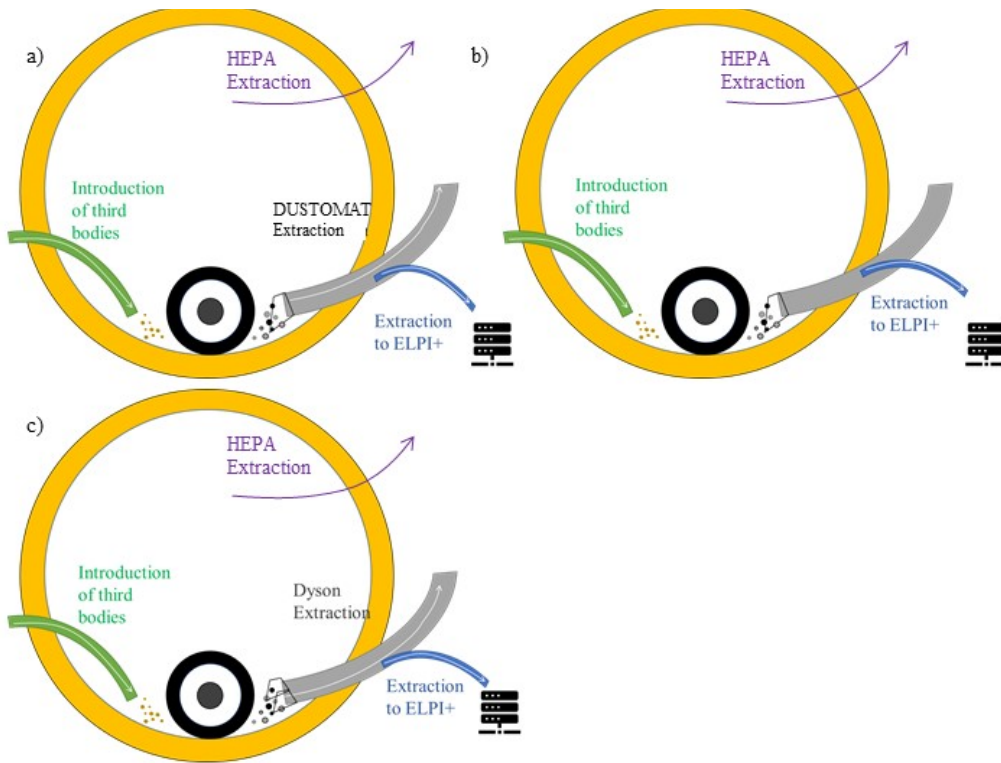


Figure S3 Extraction locations where previous sampling has been taking place in this tire rig using a) DUSTOMAT extraction system, b) no external extraction system, and 3) Dyson extraction.

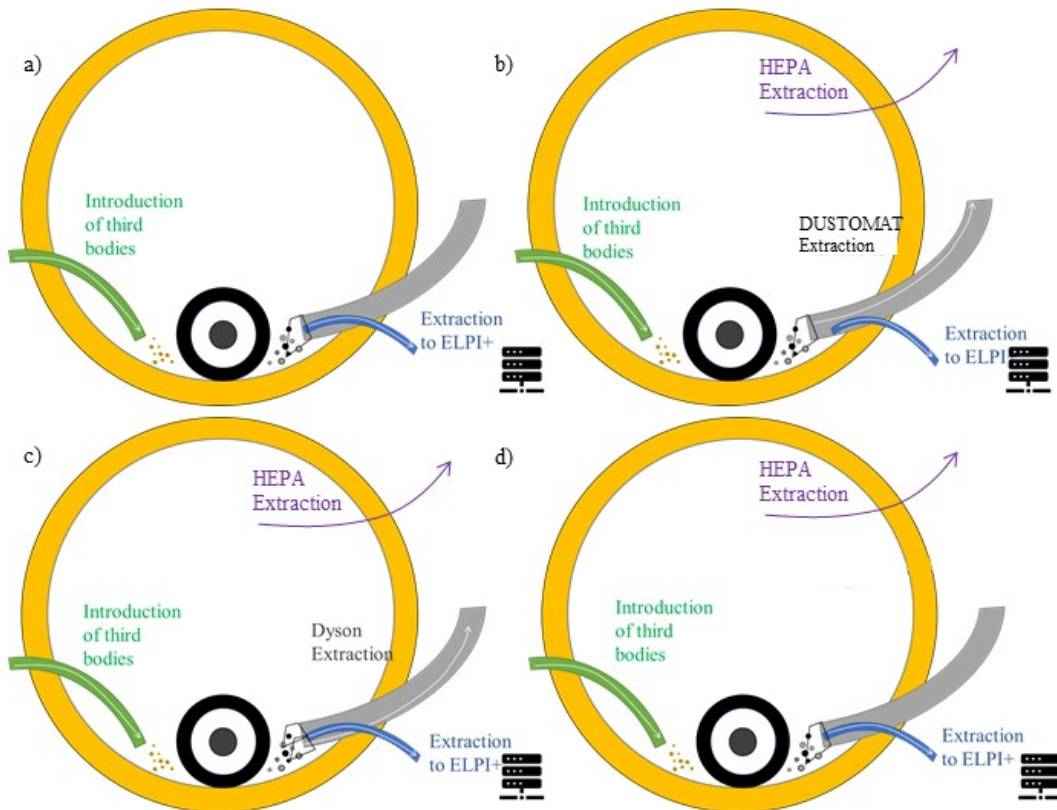


Figure S4. Sampling locations tested in the first testing period using a) no external extraction from the ELPI vacuum, b) the DUSTOMAT Extraction in addition to the ELPI vacuum, c) the Dyson

extraction in addition to the ELPI vacuum and d) using the HEPA extraction within the test rig in addition to the ELPI vacuum.

Table S1. ELPI cut off points (in μm) by stage number.

Stage	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Cut-off size (μm)	10	5.3	3.6	2.5	1.6	0.94	0.6	0.38	0.25	0.15	0.094	0.054	0.030	0.016	0.006



Figure S5. Sampling process shown for total particles (solid and semi-volatile particles) that go into the CS, with on the solid fraction coming out, which can then be sampled and sized/counted by the ELPI.

Table S2. Relative percentage of total particles generate through drive cycle. The bins that contribute 95% of the total PN (green) and PM (orange) are highlighted with and without the catalytic stripper.

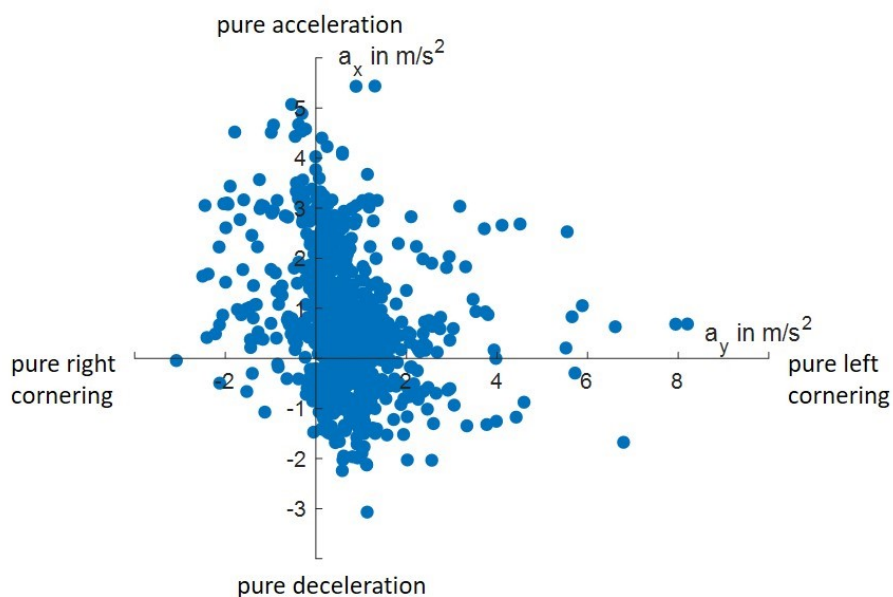


Figure S6. A graph shows the acceleration, deceleration, and left and right cornering events during the first 20 minutes of the TRWP cycle used throughout the analysis.

ELPI Bin Size (nm)	PN					PM				
	1	2	3	4	CS	1	2	3	4	CS
6	68.0%	50.4%	52.7%	59.4%	30.7%	0.0%	0.0%	0.0%	0.0%	0.0%
16	18.6%	19.0%	13.7%	18.5%	31.5%	0.0%	0.0%	0.0%	0.0%	0.0%
30	6.0%	11.5%	12.6%	10.0%	24.6%	0.0%	0.0%	0.0%	0.0%	0.0%
54	1.7%	7.3%	8.2%	5.0%	7.1%	0.0%	0.0%	0.0%	0.0%	0.0%
94	1.4%	5.3%	6.4%	3.5%	3.8%	0.0%	0.0%	0.0%	0.0%	0.1%
150	0.4%	2.8%	3.3%	1.7%	1.3%	0.0%	0.0%	0.0%	0.0%	0.1%
250	0.4%	1.1%	1.3%	0.7%	0.1%	0.0%	0.1%	0.1%	0.1%	0.0%
380	0.5%	0.6%	0.6%	0.4%	0.1%	0.0%	0.1%	0.1%	0.2%	0.1%
600	0.8%	0.5%	0.3%	0.3%	0.3%	0.2%	0.4%	0.2%	0.4%	1.2%
940	0.7%	0.5%	0.3%	0.2%	0.2%	0.9%	1.6%	0.9%	1.7%	4.7%
1600	0.6%	0.4%	0.3%	0.2%	0.1%	3.1%	5.1%	3.7%	5.7%	11.9%
2500	0.4%	0.3%	0.2%	0.1%	0.1%	8.1%	12.4%	9.8%	13.5%	16.0%
3600	0.3%	0.1%	0.1%	0.1%	0.0%	18.3%	22.5%	19.1%	22.9%	26.6%
5300	0.3%	0.1%	0.1%	0.0%	0.0%	69.4%	57.8%	66.0%	55.5%	39.2%

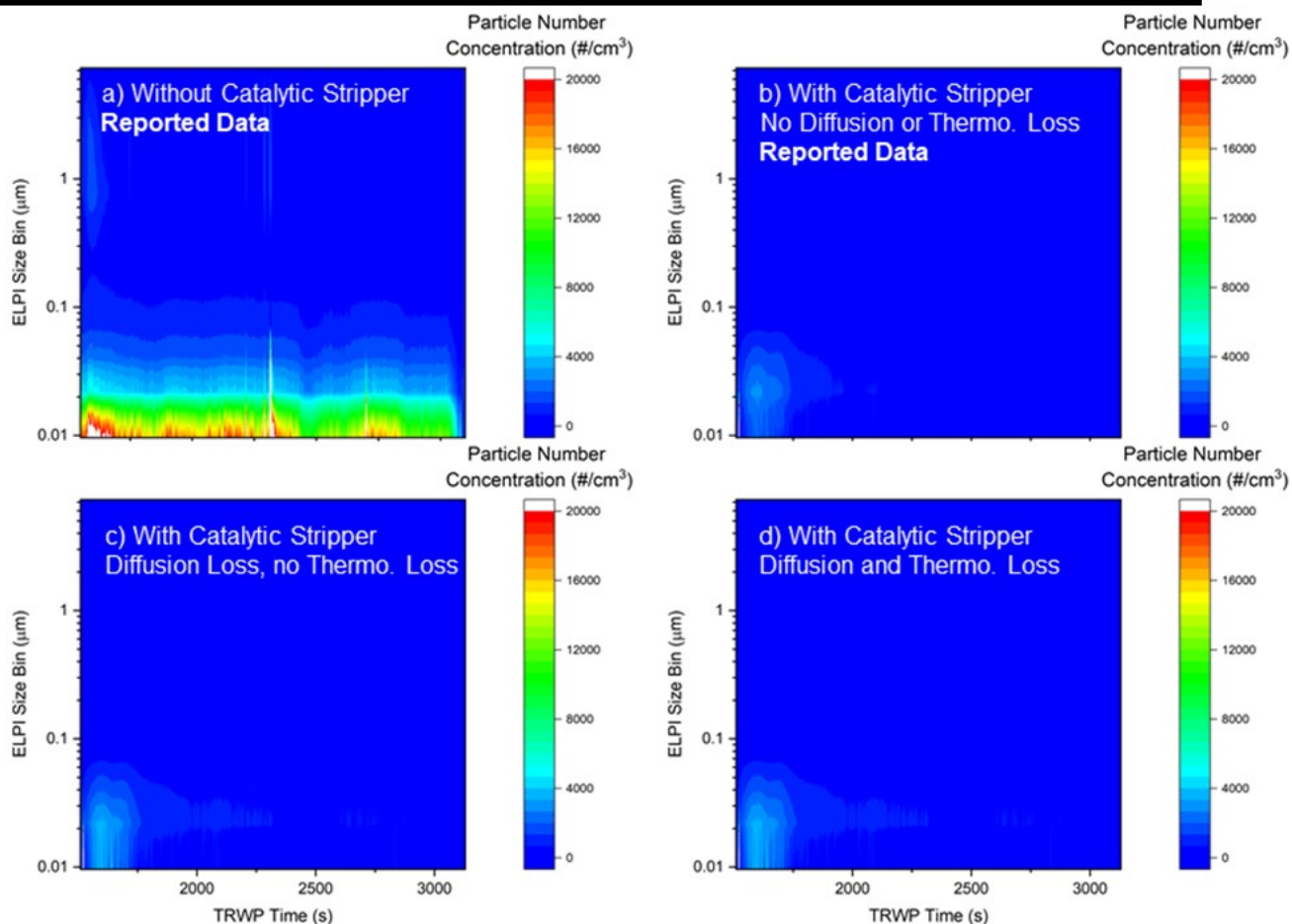


Fig. S7. A) Reported data as shown in the manuscript without the catalytic stripper (thus no diffusional or thermophoretic losses), b) data with the catalytic stripper reported, c) data with the catalytic stripper and diffusional losses corrected for and d) data with the catalytic stripper and diffusional and thermophoretic losses accounted for.

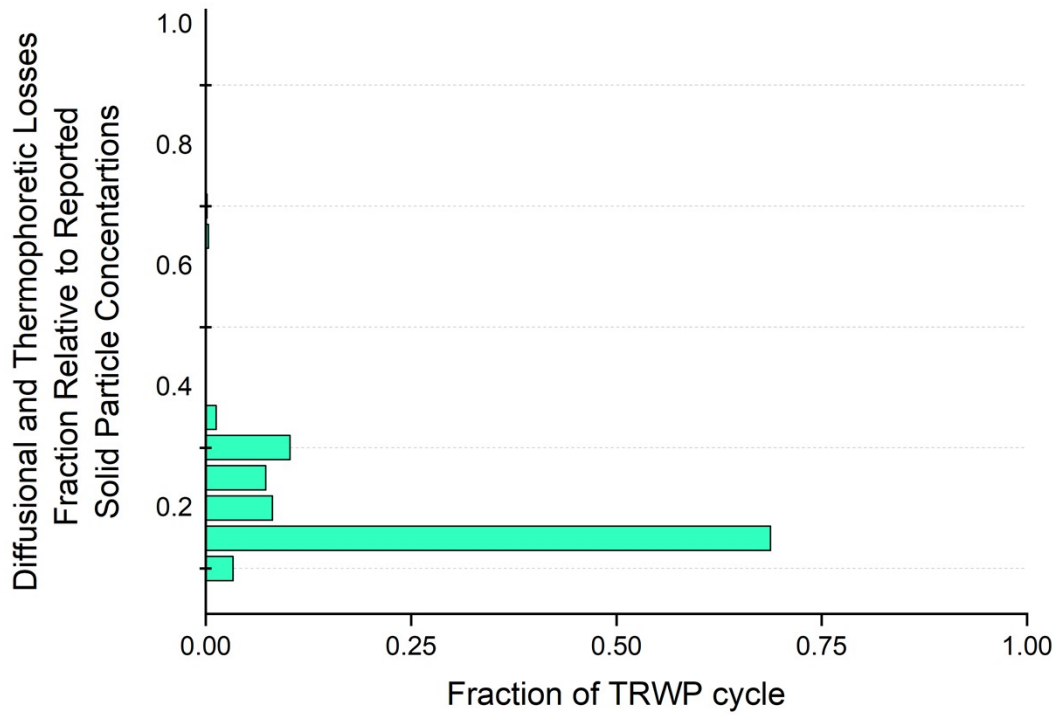


Fig. S8. Fraction of solid particles that may be excluded due to diffusional and thermophoretic losses over the fraction of the TRWP cycle. Low fractions indicate low particle loss over the entire cycle.

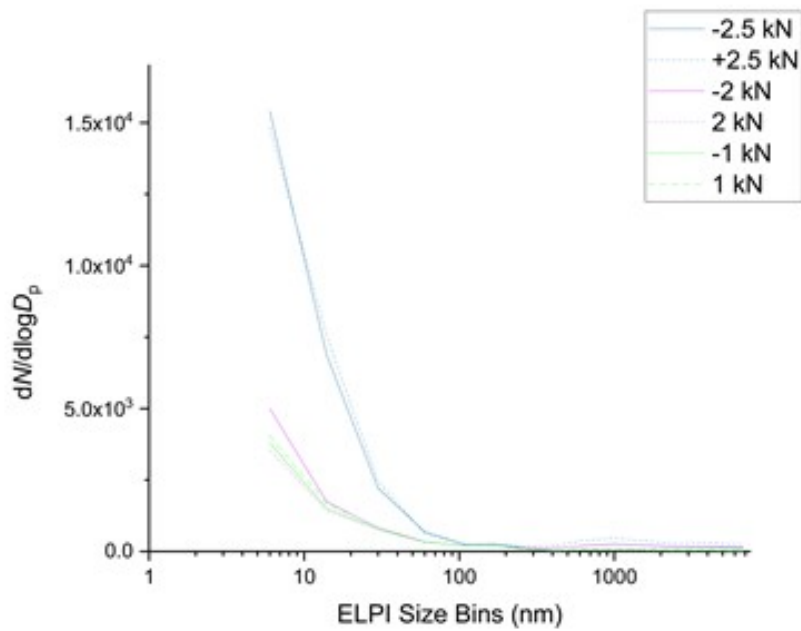
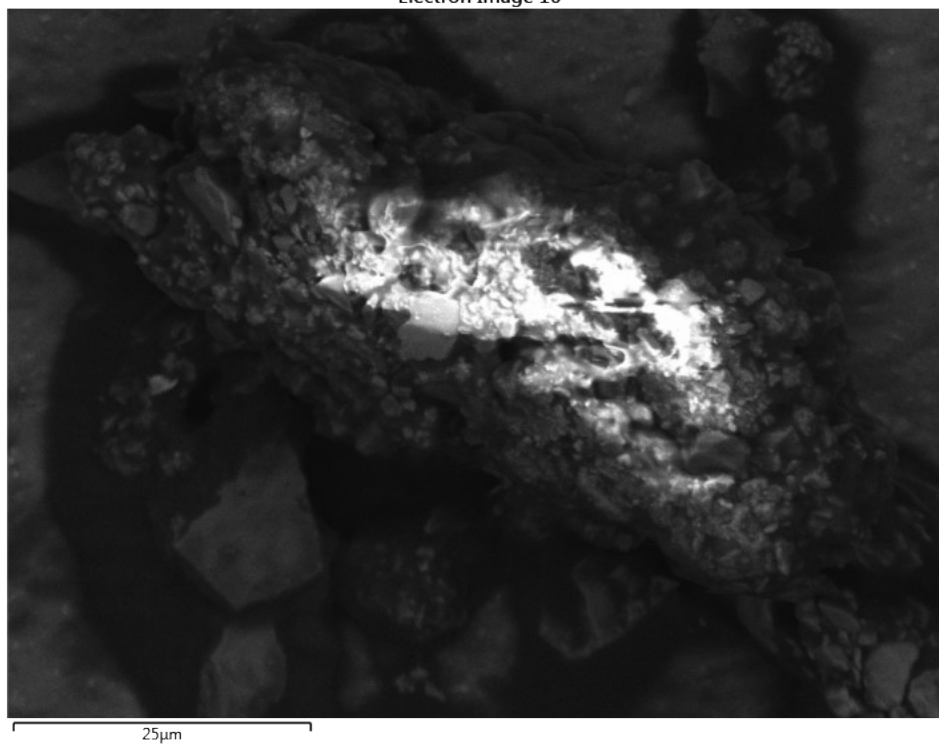
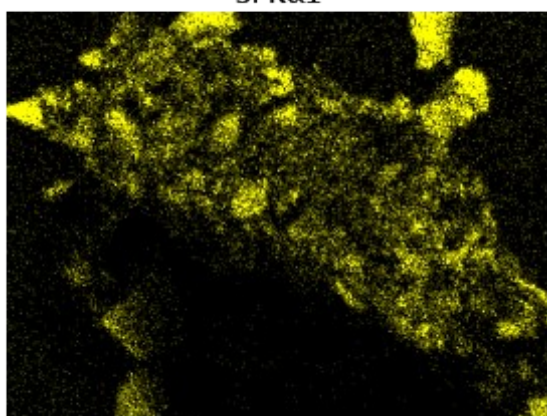


Fig. S8. Normalised particle size distribution for the steady-state cycles by force.

Electron Image 16



Si K α 1



O K α 1

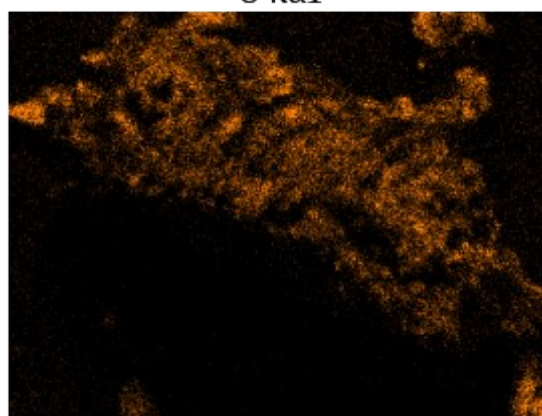


Figure S8. a) Scanning electron microscopy of particles $>10 \mu\text{m}$ on an aluminium substrate with b) silicon highlighted in yellow and c) oxygen highlighted in orange identified with EDX analysis.

a)

are likely a combination of third body sand and tire particles.

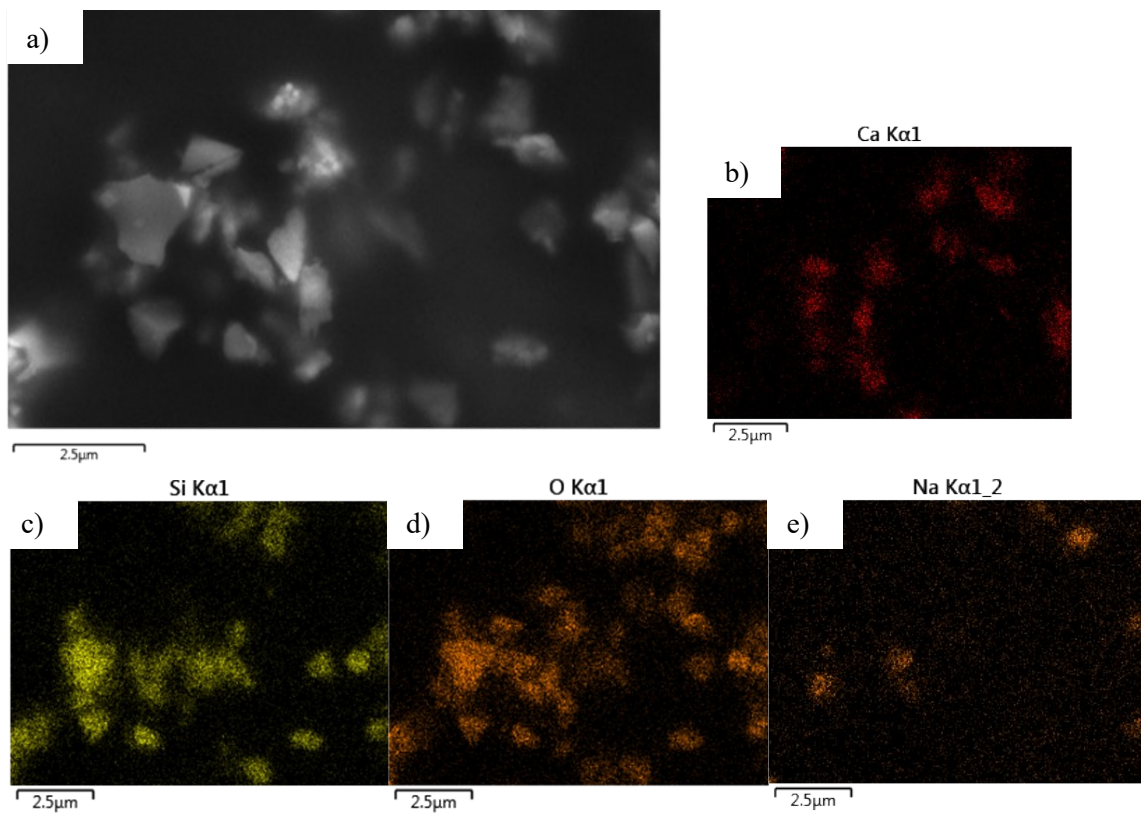


Figure S9. a) Scanning electron microscopy of particles 1 μm on an aluminium substrate with b) calcium, (c) silicon, (d) oxygen and (e) sodium identified via EDX analysis.

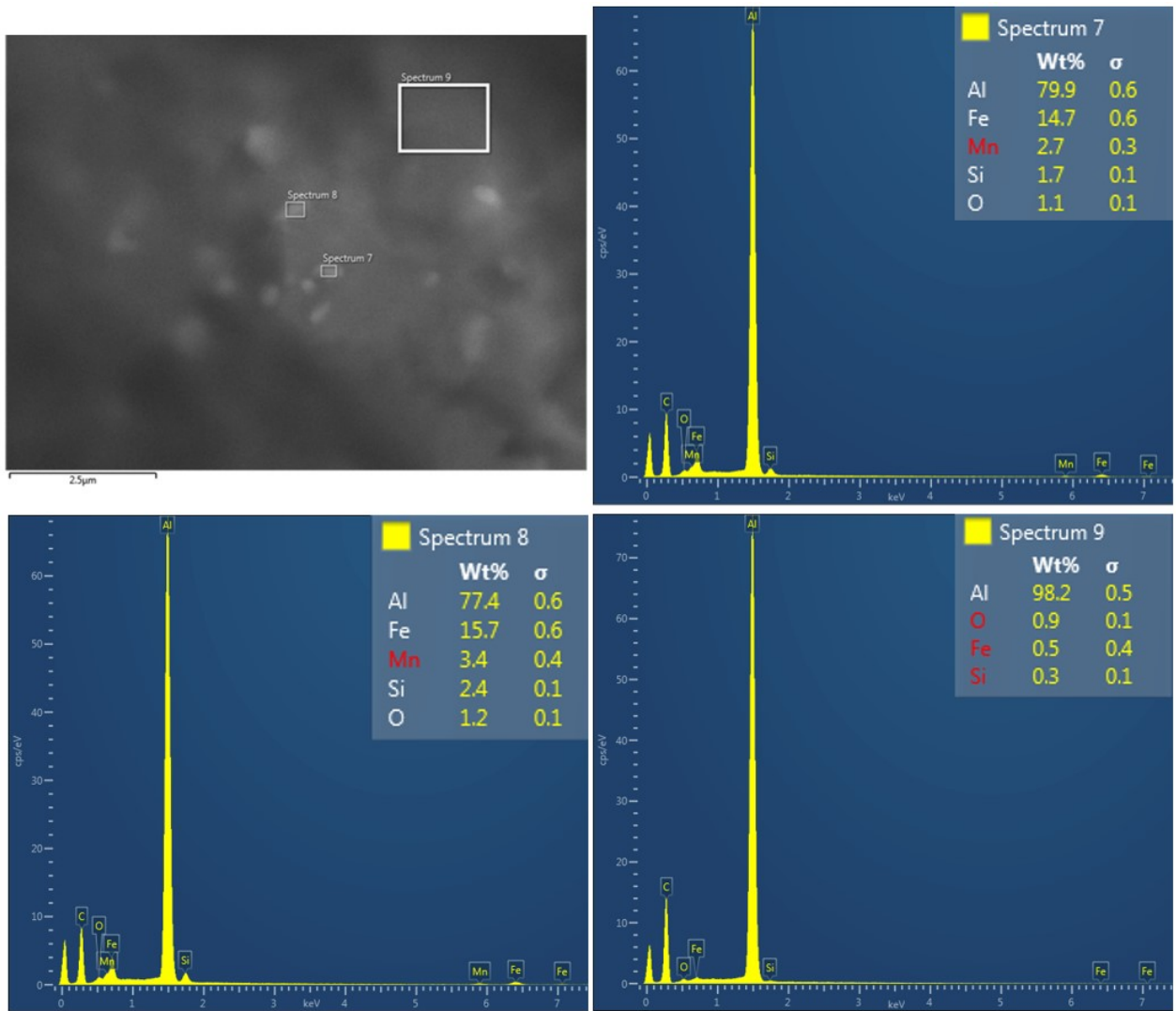


Figure S10. a) the SEM image showing a background area (Area 9) and two particles (Areas 7 and 8) on stage with cut point 70 nm, b) represents the elemental spectrum for the particle in Area 7 and c) elemental spectrum for the particle in Area 8, and d) the elemental spectrum for the background Area 9.