Analysing Nanoparticle Emissions from Tyre Wear during Normal and Severe Drive Cycles: Size Distribution, Morphology and Composition

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Tire and road wear particles (TRWPs) are becoming a growing concern for on-road emissions, specifically with non-combustion vehicles. Characterizing TRWPs is essential for understanding the health and atmospheric implications for zero-(tailpipe)-emission fleets. The University of Cambridge has been investigating how to generate TRWP emissions that simulate real-world driving conditions via real-time (online) analysis, and offline particle and toxicology analyses. This has been done by characterising TRWPs using an Electrical Low-Pressure Impactor instrument, particle number, lung deposited surface area, and particle mass. With these results, we can determine key particle metrics for TRWPs that must be maintained within toxicity and health studies.

Third bodies, an external source of particles, were used to simulate real-world driving conditions within a laboratory setting. Differentiating between third body particles and generated TRWPs is crucial for characterizing nanoparticles in real-world environments and thus a main focus of this work. The methodology to evaluate background concentrations during testing, comparisons to chemical composition of the third bodies, and managing legacy particles will be used for future laboratory testing of tire emissions and implemented in field campaigns investigating nanoparticle TRWP emissions.

Further detailed chemical analysis of the TRWPs uses instrumentation at the MRC Toxicology Unit. With this work between the Engineering Department and MRC Toxicology unit in Cambridge, key toxicity characteristics are established, which are valuable for improving tire composition during the manufacturing process, as well as exploring how various driving patterns can improve tire wear emissions.